6(a) Baseband Troubleshooting

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Introduction to NHM-10 troubleshooting

This document is intend to be a guide for localizing and repairing electrical faults in the NHM-10 device. First there is a brief guide for fault localizing. Then fault repairing is divided into troubleshooting paths.

Before any service operation you must be familiar with the NHM-10 product and module level architecture. You have to also be familiar with the NHM-10 specified service tools such as the Phoenix service software, flashing tools and software.

General guidelines for NHM-10 trouble shooting

Tools needed for troubleshooting

- Service tools (as listed at service tools chapter in service manual)
- Laboratory power supply with current indicator
- Oscilloscope
- Digital multimeter ...

General guidelines

If the device cannot be turned on by any means, see "dead device" trouble shooting

Current consumption (missing consumption) gives an idea whether the device is able to start up.

Dropping supply voltage or very large current consumption indicates a short circuit

Check whether the connection with Phoenix works and what can be discovered with Phoenix (ADC-readings, baseband selftest, bb-calibrations etc.)

Check baseband selftests with Phoenix if "CONTACT SERVICE" is shown on the display.

Check visually display and rocker faults

Force phone to LOCAL mode and make keyboard test by phoenix

Check that board-to-board connector is OK, and connectors make good contacts.

If liquid damage, stop repairing!

Flash phone before disassembling it if fault is not obvious and Phoenix connection is OK.

Disassemble phone:

Try to locate failed module, is it LG4, UI or camera module.

Check failed module visually:

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Mechanical damages?

Solder joints OK?

Continue with specific trouble shooting procedure for the module:

If there is an obvious fault, repair it before reflashing the device

Flash first if a fault is not obvious

If flashing is not working go to flashing trouble shooting

Due to CSP packages short circuits or broken solder joints are not easily seen. If the examined signal seems to be continuously in low or high level, then measure for possible short circuit to ground (signal low) or to supply voltage (signal high) Note that if a problem is not found from any visible contact/component it can be under CSPs where the signal is connected.

Care must be taken when assembling and disassembling the transceiver. Failure to do this may result in unnecessary damage to device.

NOTE! if some ASIC is changed see chapter Camera Module Troubleshooting

Nominal current consumption

NOTE: Service tools need some amount of current to work.

The following current consumption values are measured from a complete NHM-10.

Vbatt = 3.6V

Measured nominal currents are drawn from the main battery.

Measurements have been made with a current probe connected to an oscilloscope.

Operating mode	Current consumption
Idle	90 mA
2w audio call (backlights off)	350 mA
Viewfinder	260 mA

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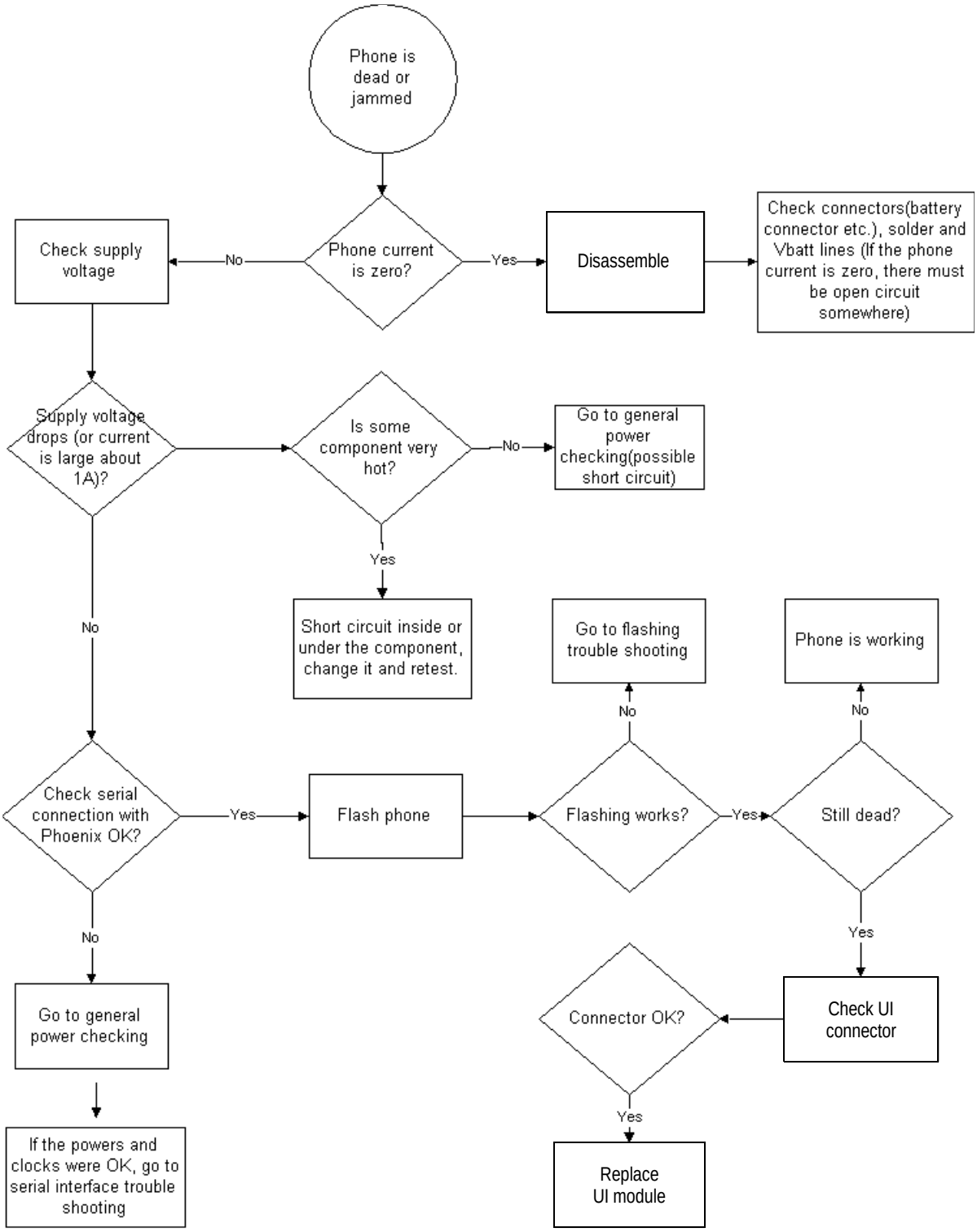
Trouble shooting paths

Dead or jammed device



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Partially damaged device

If the device is working, but some functionality is missing try to localize where the problems is and see relevant part of this manual. E.g audio is not working see "Audio Troubleshooting" , if charging is not working see chapter Charging troubleshooting etc.

Most common symptoms reported by customer

In this chapter is described most common symptoms reported by customers when the device is brought in for service. Some tips where the trouble can be found are given also. When troubleshooting use these tips and follow the given troubleshooting path.

Most common symptoms for audio problems

"Earpiece sound is missing"
"Handsfree sound is missing"
"Headset is not recognized"
"Microphone is not working"
"Volume cannot be adjusted"
" Ringing tones does not work"
"Audio volume too low"

If symptom is something like above see audio troubleshooting.

Most common symptoms for Irda and Bluetooth problems

"Irda does not work or not make a connection"
"Bluetooth does not work or connection cannot be established"

If symptoms are something like those, start to follow Irda or Bluetooth trouble shooting guide lines gave relevant chapters.

Symptoms related to energy management

"Phone does not stay on"
"Charging is not working"
"Time is lost during battery change"
"Charging takes too long"
"Operating time is very short"

These symptoms lead to relevant part of energy management troubleshooting

Problems related to UI-module:

"UI-module keypad is not working"
"Joystick is not working"
"Backlight is dim"
"Backlight not even"
"Backlight is blinking"
"Keypad or display backlight is not working"
"Display related problems"

See UI- module troubleshooting.

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Most common RF related symptoms:

"Call cannot be made"
"Phone does not find signal"
"Call is often dropped"
See RF troubleshooting

Problems related to camera

"Bad image quality"
"Picture cannot be taken"
See camera module trouble shooting

ASIC is changed

ASIC's can be changed only at a defined service level.

UEM changed

If UEM is changed baseband calibrations should be made. New IMEI must be programmed also. ZOCUS calibration is not necessary.

UPP_WD2 changed

IMEI must be reprogrammed.

ZOCUS changed

Zocus must be re-calbrated

Test points

Test points in BaseBand area (CS7)

Test point	Signal	Test point	Signal	Test point	Signal	Test point	Signal
J110	DBUSClk	J201	CARDATA	J260	VBAT_SMPS	J449	PURX
J111	DBUSDA	J202	MICDATA	J262	GENIO7	J470	UPPWD2 MMCClk
J113, J114, J185 -J191	LCD	J203	SIMIO	J301	IRRX		
		J204	SIMClk	J311, J312, J313	FlashCE	J471	UPPWD2 MMCCmd
J116, J118, J119, J175 - J180	Keymat	J205	SIMIOCtrl				
		J206	MBUSTX_I	J314	SDRAMClk	J472	UPPWD2 MMCData
J123	SLEEPClk	J207	MBUSRX_I	J315	FlashClk		
J124	SLEEPX	J208	FBUSTX_I	J389	BSIZE	J473, J474	MMCDir
J125	PURX	J209	FBUSRX_I	J399	ZOCUS Interrupt	J475	SIMData
J145	ROCKER2	J210	RFCONVClk			J476	SIMClk
J170	SDRAMClk	J211	RXID	J401	MMCCmd	J477	SIMReset
J181	ROCKER1	J212	RXQD	J402	MMCClk	J619	VR3
J182	ROCKER3	J213	TXID	J403	MMCData		
J183	ROCKER4	J214	TXQD	J438	USARTRX		
J184	ROCKER5	J215	AOXD	J439	USARTTX		

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"CONTACT SERVICE" on display

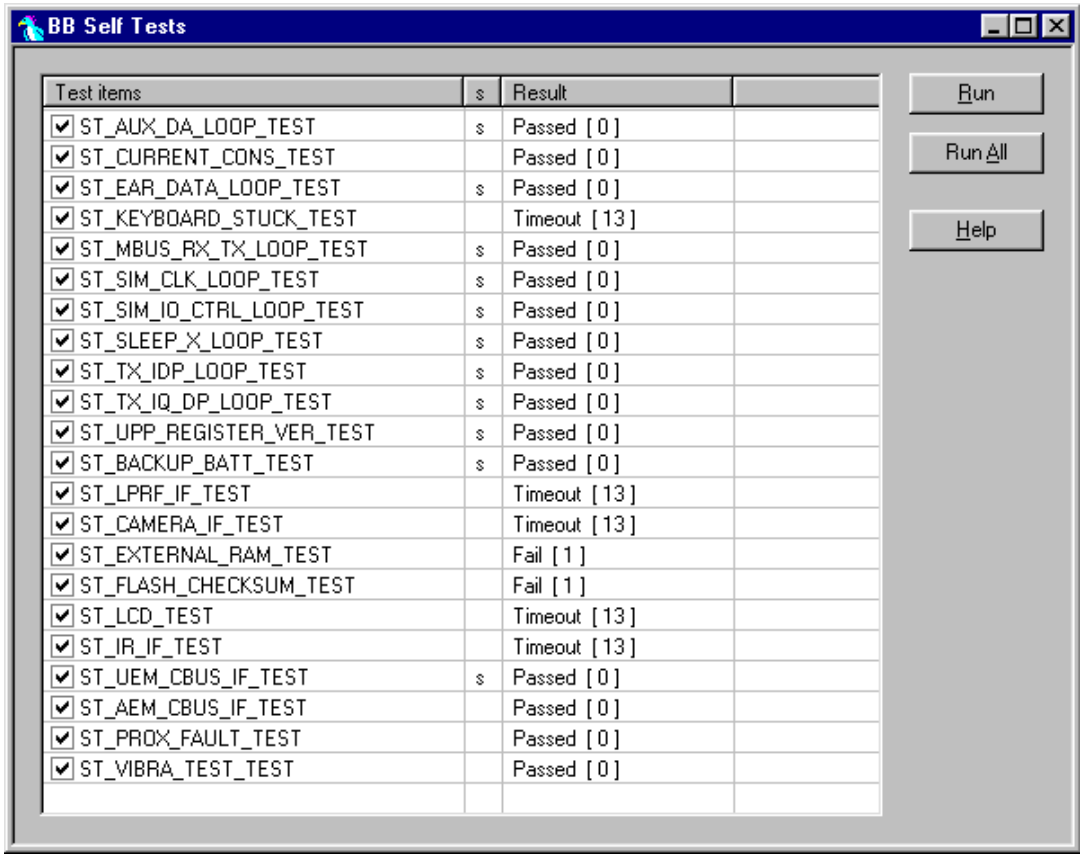
CONTACT SERVICE on display (Self-tests by Phoenix)

Display information: **"Contact Service"**

This fault means that software is able to run and thus the watchdog of UEM can be served.

Selftest functions are executed when the phone is powered on and if one or more selftest functions fail, the message "Contact Service" is shown on the display.

MCU selftest cases can be split into two categories: The ones that are executed during power up and the ones that are executed only with a PC connected. These test and the items included are as follows:



If some selftest is failed, see relevant chapter in this troubleshooting document.

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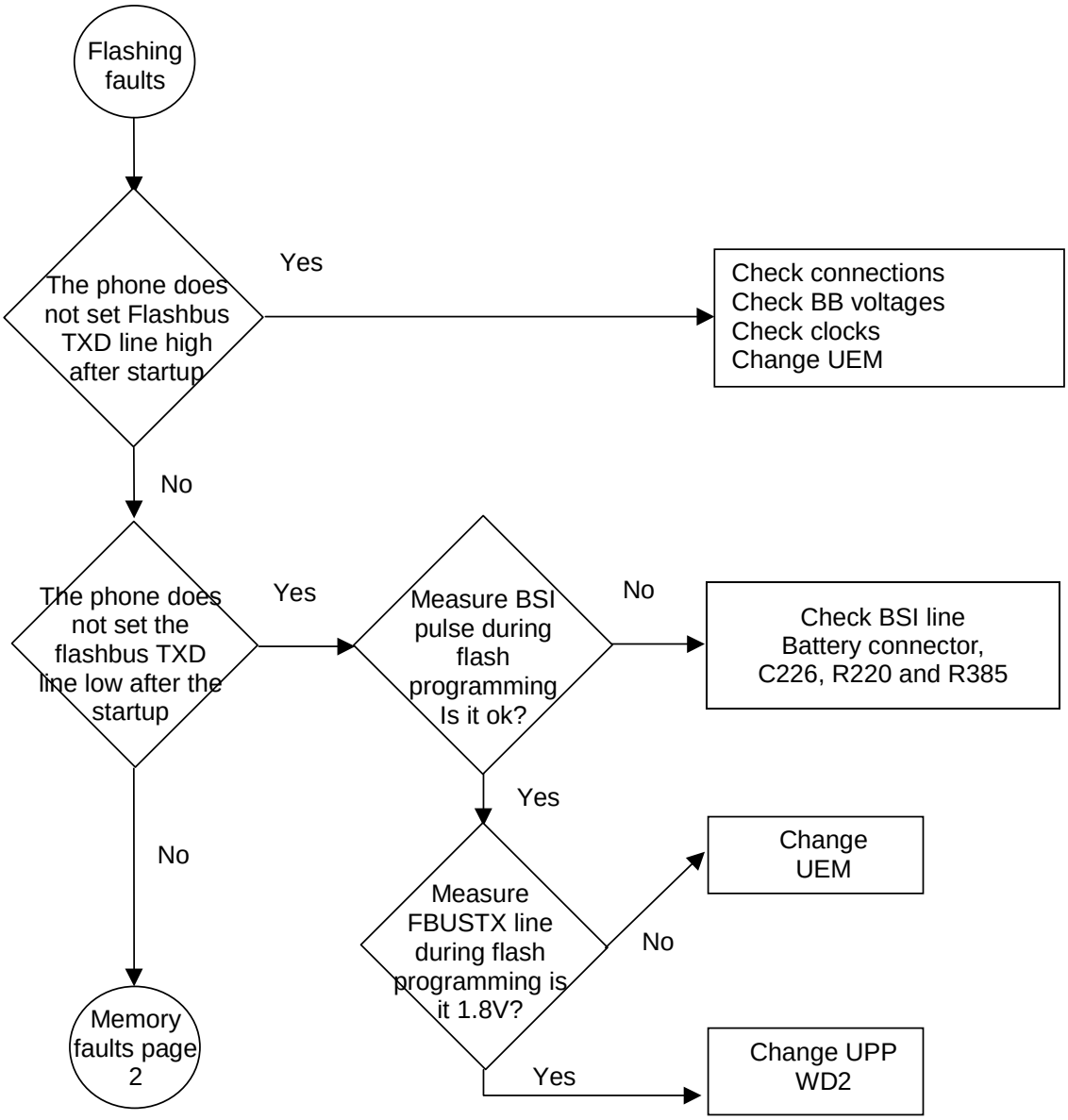
CS7 Baseband HW subarea troubleshooting

Flashing troubleshooting

NHM-10 has three memory components installed on the main pwb. The best indication of which one is causing problems can be obtained by flashing the device. It has to be kept in mind that all three flashes are interfaced with UPP WD2 asic that might it self have some problems. The necessary steps are described below. Phoenix error messages during flashing greatly help on defining what is wrong. To be able to flash the device, most device BB area components must function properly.



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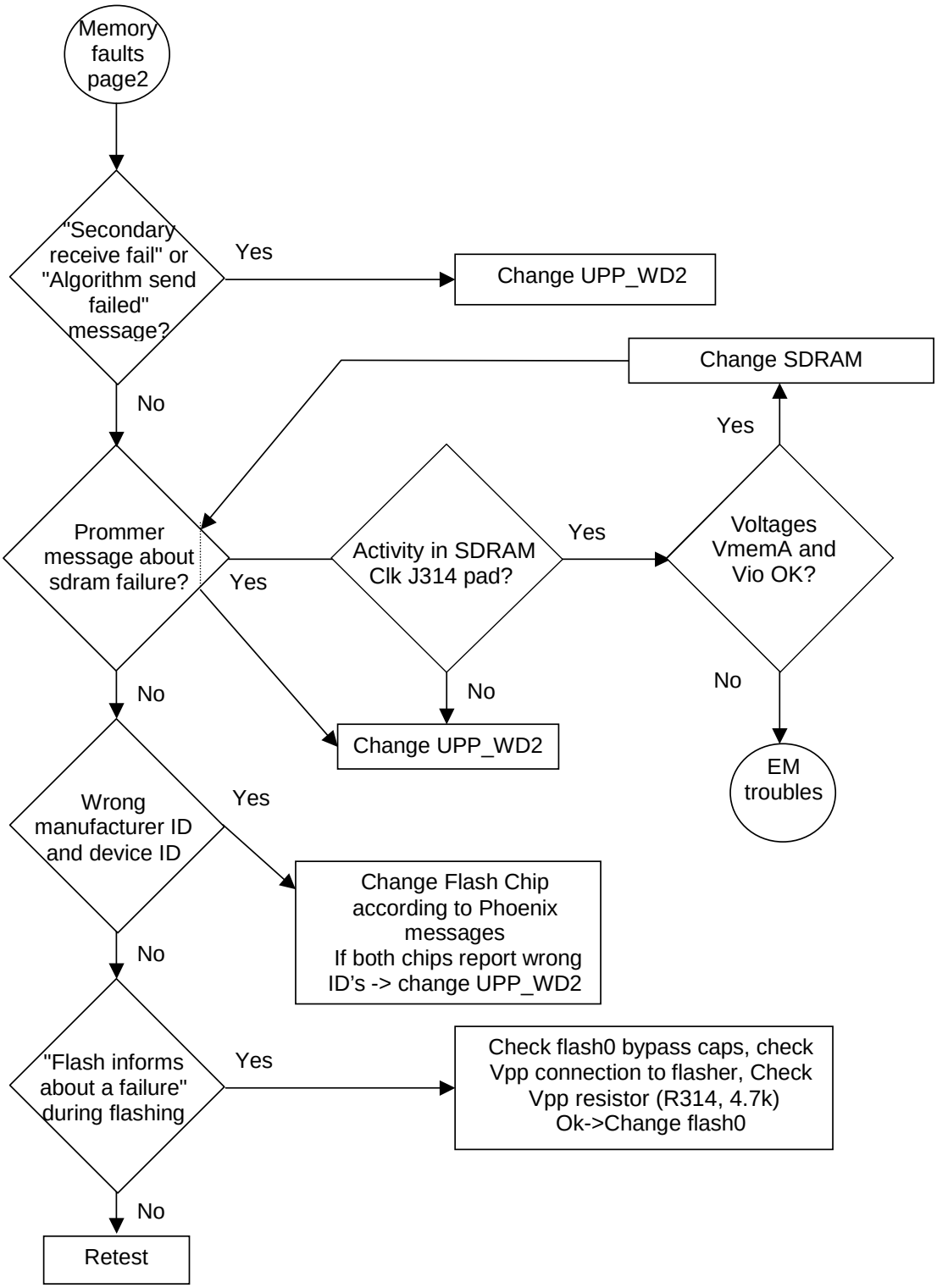

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Energy management troubleshooting

Device does not stay on

If the device is switched off without any visible reason, there may be problems in the following areas:

- UEM watchdog problem (WD is not updated by SW)
- BSI line problem (BSI line is floating => contact failure)
- Battery line problem
- Soldering problem

The most likely reason is UEM WD (watchdog), which turns the device off after about 32 seconds if SW is jammed.

This may caused by SW problem, UPP_WD2 problem (Not server by SW), UEM or memory malfunctions.

The following tests are recommended:

- General power checking
- Clocks
- Memory testing
- Serial Interface

If there is something wrong in BSI line, the device seems to be dead after the power key is pressed. However the regulators of the device are on a few seconds before the power-down.

This mode can easily be detected from the current consumption of the device. After a few seconds the current consumption drops almost to 0 mA.

In this case check component or soldering

- Battery connector X606
  EMI-filter R385
  UEM D190 (pin number C2)

If phone boots to TEST or LOCAL mode with normal battery, BSI is short circuited to ground. Check EMI-filter and filtering capacitors, which are located to BSI.

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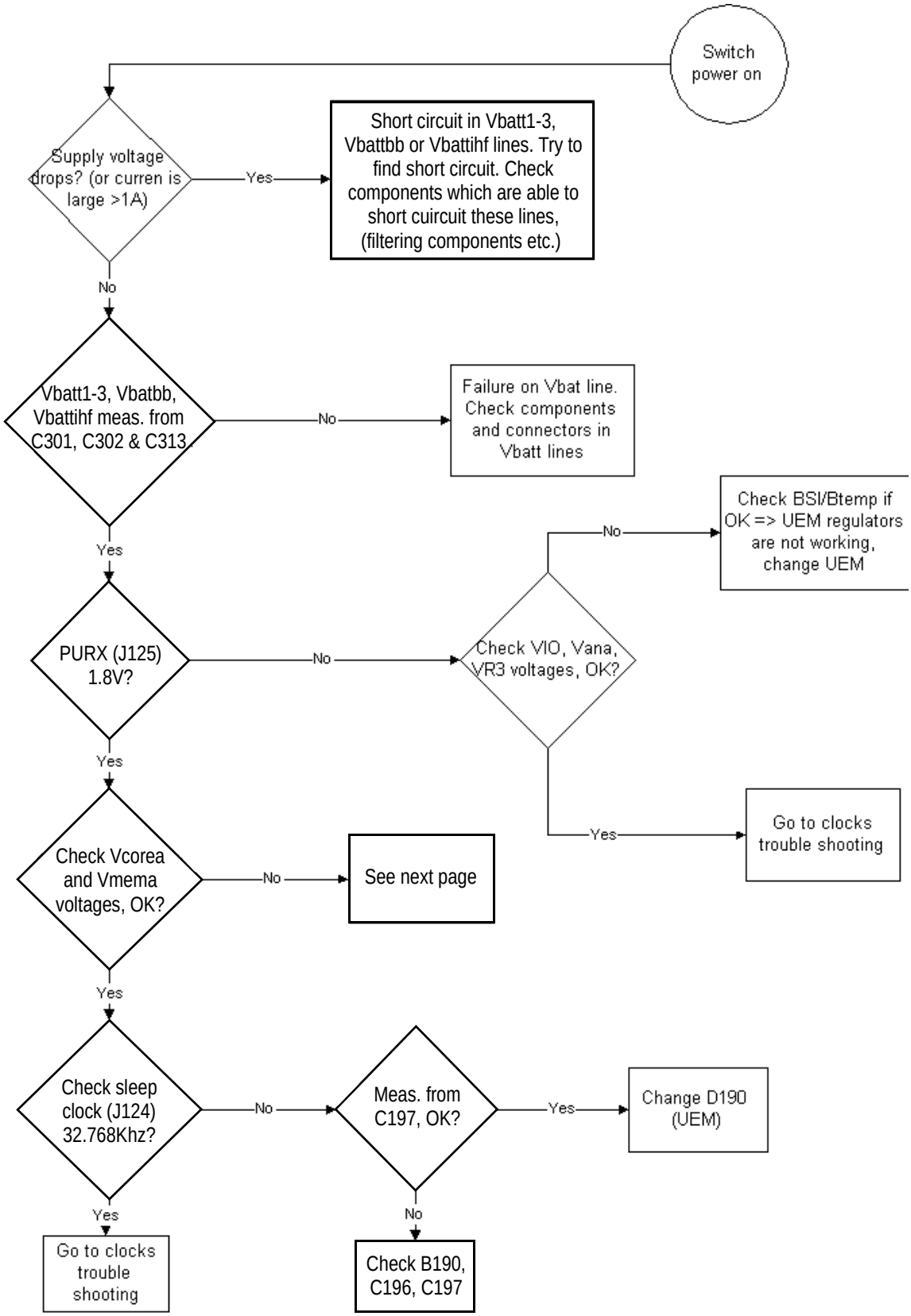
General power checking

Use service tool FLA-21. Battery voltage should be at least 3.6V. After phone disassembly, use module jig MJS-9Q.


Switch power on
Supply voltage drops? (or curren is large >1A)
Yes
Short circuit in Vbatt1-3, Vbattbb or Vbattihf lines. Try to find short circuit. Check components which are able to short cuircuit these lines, (filtering components etc.)
No
Vbatt1-3, Vbatbb, Vbattihf meas. from C301, C302 & C313
No
Failure on Vbat line. Check components and connectors in Vbatt lines
Yes
PURX (J125) 1.8V?
No
Check VIO, Vana, VR3 voltages, OK?
No
Check BSI/Btemp if OK => UEM regulators are not working, change UEM
Yes
Go to clocks trouble shooting
Yes
Check Vcorea and Vmema voltages, OK?
No
See next page
Yes
Check sleep clock (J124) 32.768Khz?
No
Meas. from C197, OK?
Yes
Change D190 (UEM)
Yes
Go to clocks trouble shooting
No
Check B190, C196, C197

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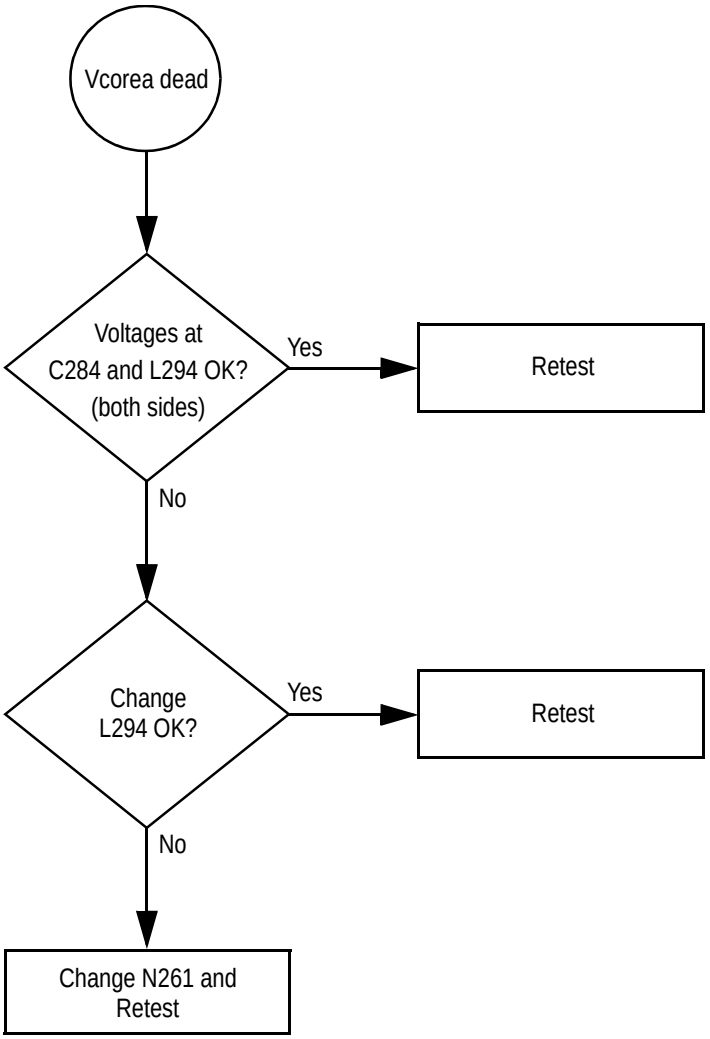
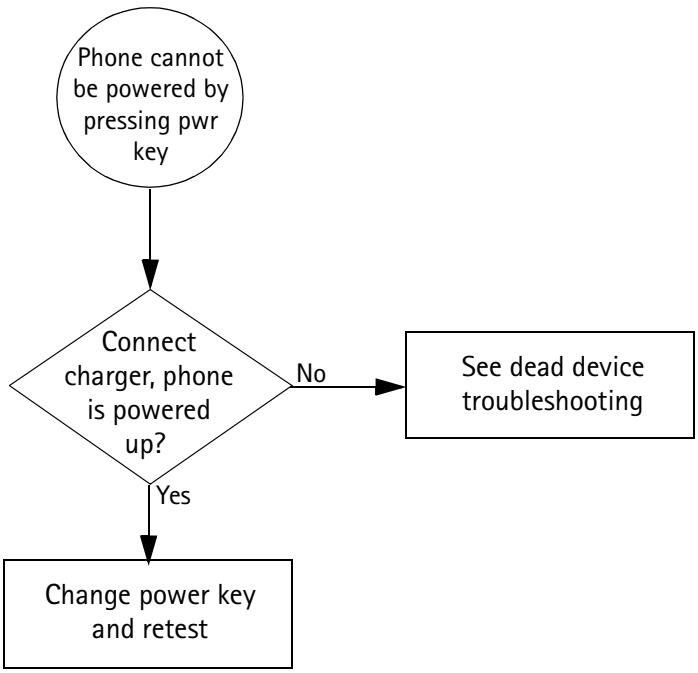


Power key trouble shooting


Phone cannot be powered by pressing pwr key
Connect charger, phone is powered up?
No
See dead device troubleshooting
Yes
Change power key and retest

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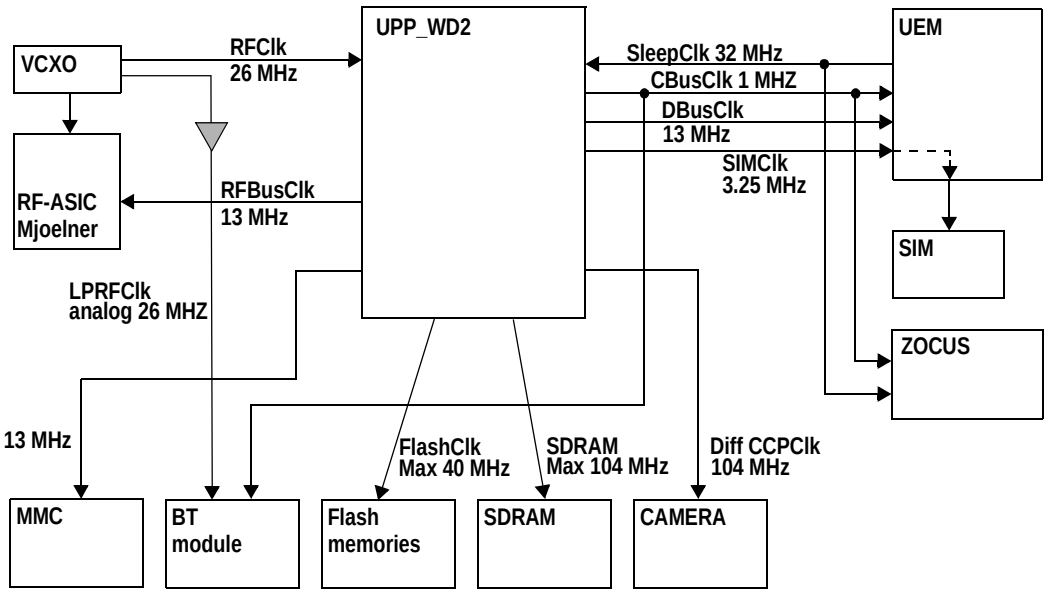
Clocks troubleshooting

Clocks include the following:

- RF-clock
- CAMclk
- DBUS, CBUS clocks
- Flash and SDRAM clocks
- Sleep clock
- Bluetooth clock
- SIM clock
- MMC clock

The main clock signal for the baseband is generated from the voltage controlled crystal oscillator VCXO. This 26 MHz triangle wave clock signal is supplied to OSC_IN pin of Mjoelner and out to UPPWD2. Inside UPPWD2 the clock frequency is divided to 13 MHz and then fed to RFCLK.



In SLEEP mode the VCXO is off. UEM generates low frequency clock signal (32.768 kHz) that is fed to UPP_WD2, Bluetooth and ZOCUS.

When the flashing of the device does not succeed, but powering is OK, follow these instructions.

Note: The absence of clocks may indicate that the device (put phone to LOCAL mode when the sleep is not allowed or press buttons so that phone is not in sleep mode) is in sleep mode. Make sure that the device is not in sleep during clocks measuring.

IMPORTANT: Clock signals have to be measured with 1MΩ (or greater) probes!

Measure signal from J170. This should be 26Mhz clock signal. See RF Troubleshooting for further information.

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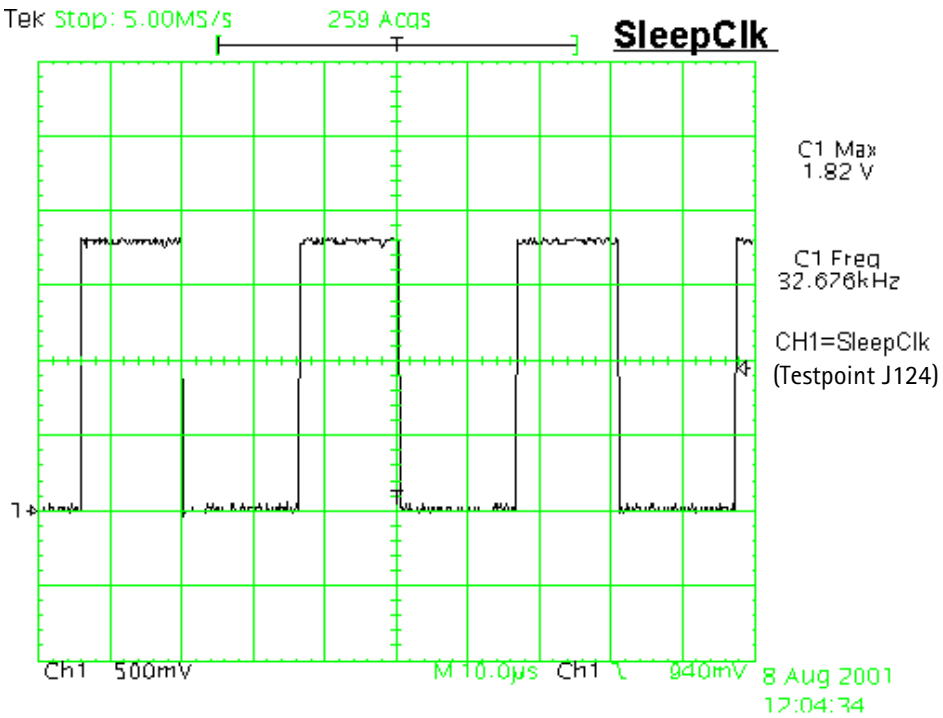
Check the crystal oscillator (B190) is oscillating at 32.768kHz frequency. If not change B190. If OK measure sleepclk from test point J124. Frequency should be the same 32.678kHz (see Figure 1, "Sleep clock," on page 17 below.) If not change UEM.

Figure 1: Sleep clock



Charging checking

Use the BL5-C battery and JBV-1 calibration set to test charging. (NOTE: power supply cannot be charged if it not has a current sinking capability.) When you are charging totally empty battery, remember that start-up charging might take a little bit longer time than normal. During this time display is blank.

If charger is not NMP approved type and its current and voltage is not within NMP charger window then software does not start charging and there is "NOT CHARGING" on the display. Voltage should be between 5.3V - 9.5V and current between 200mA – 900mA

Remove and reconnect battery and charger few times before you start to measure device. This check ensures that the fault really exists.

(Refer to "Charging troubleshooting")

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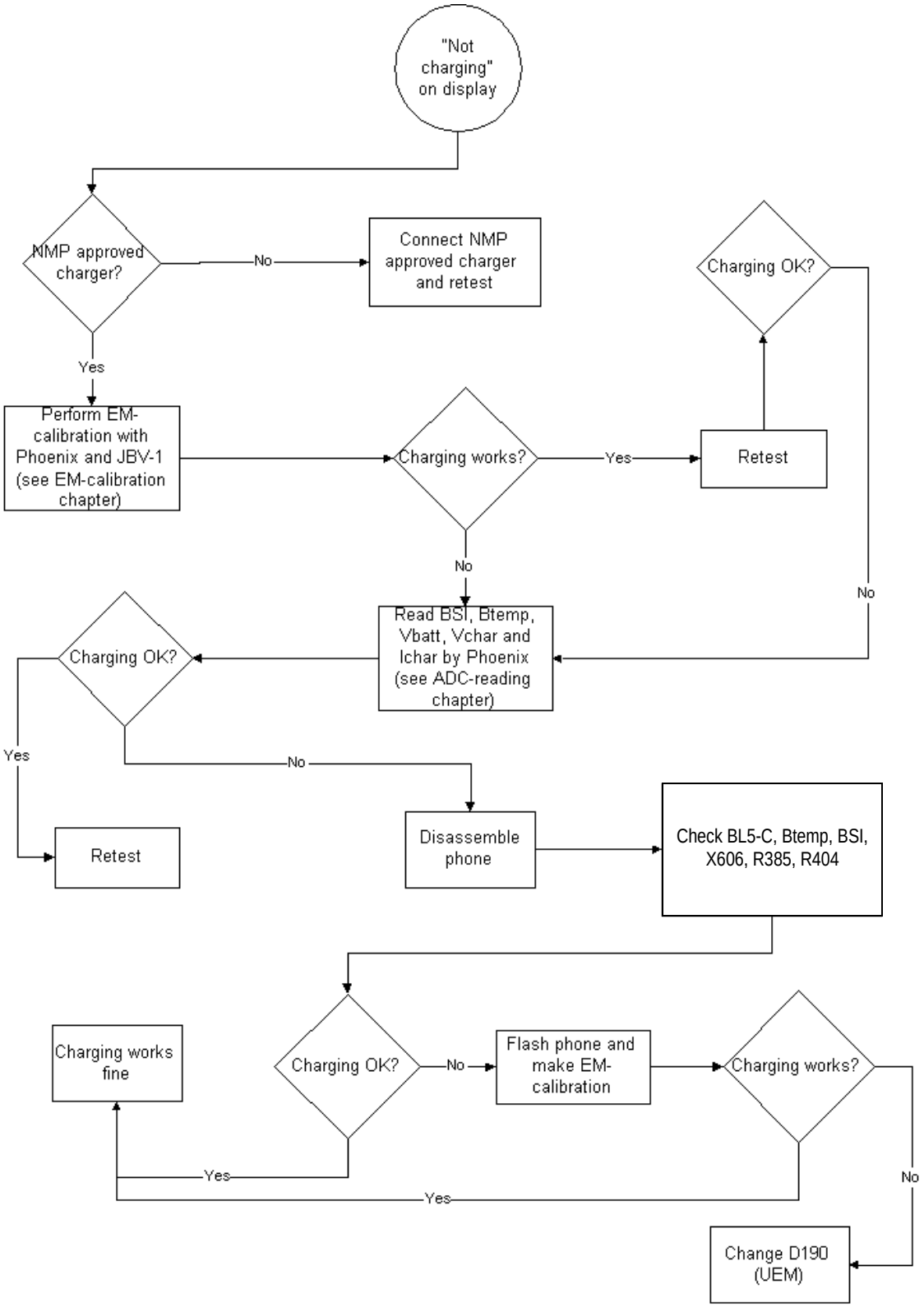
Figure 2: Charging troubleshooting



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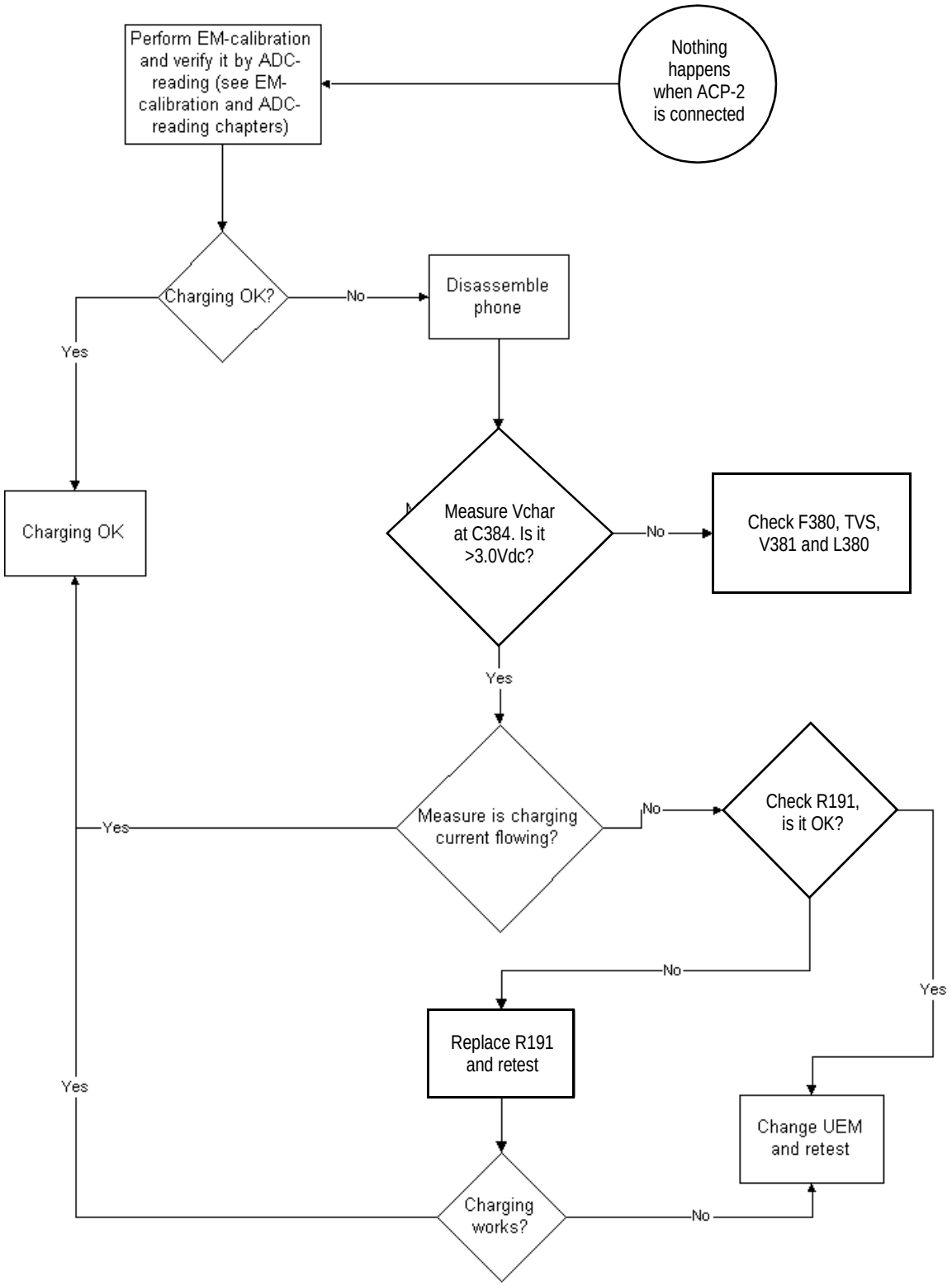

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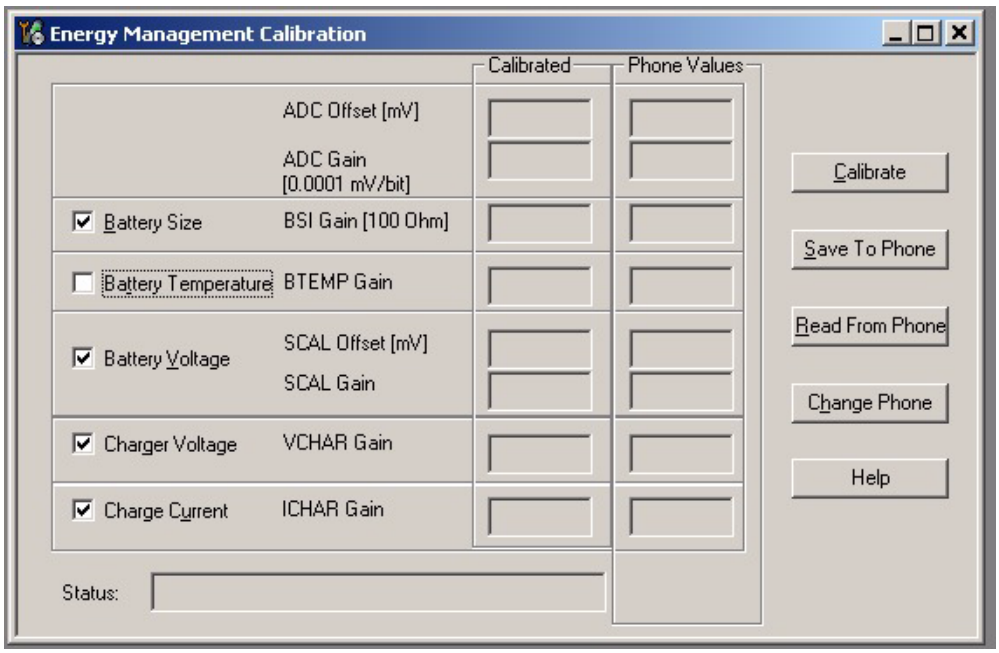
Energy management calibration

During energy management calibration A/D-converter, BSI, Btemp, Battery voltage, Charger voltage and Charger current are calibrated.



Limits for calculated calibration values are as follows:

Channel	Low	High
ADC Offset	-50	50
ADC Gain	26000	29500
BSI Gain	860	1180
Vbatt Offset	2400	2600
Vbatt Gain	10000	11000
Vchar	57000	63000
Ichar	3600	5000

ADC-offset over limits:
Inspect BSI line and components in it (R385, Pull-up resistor R220). If these are OK, change UEM.

BSI Gain over limits:
Inspect BSI line and components in it (R385, Pull-up resistor R220). If these are OK, change UEM.

Vbatt offset and Gain:
Inspect Vbatt lines and component in it.

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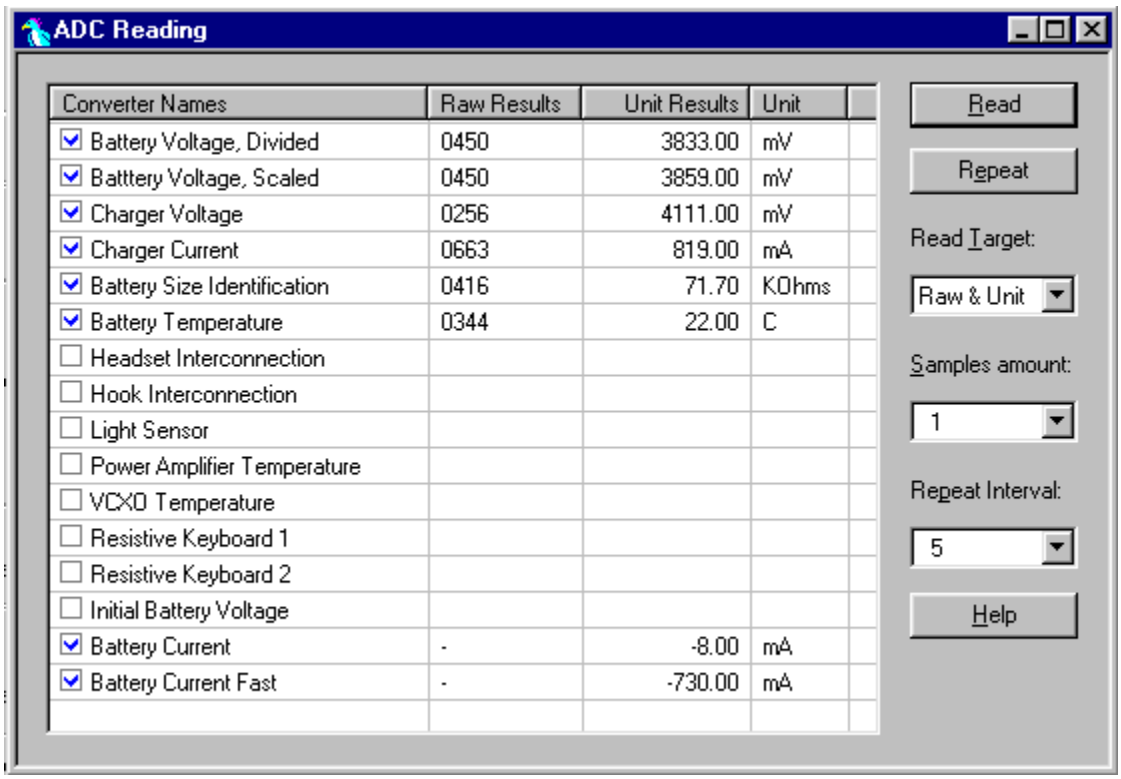
Vchar over limits:
Inspect components which are connected Vchar line: V381, F380 and L380

Ichar over limits:
Inspect components which are connected at Vchar line. If those are OK, First change current sense resistor (R191), if calibration is not still successful change UEM.

Calibration can be checked using ADC-readings. Known voltages, currents and resistances are fed and read by ADC-readings, read values and known values can be compared.

ADC-reading

Divided and scaled battery voltage, Charger voltage, Charger current, BSI and Btemp values can be read by this tool. Read values few times before you can be sure that results are accurate.



NOTE: IF Vbatt Scaled and Divided unit results are different default calibration values are used. In this case perform EM-calibration to get full performance of phone.

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Maximum tolerances are:

Reading	Check point	Tolerance
Reading	Check point	Tolerance
Vbatt SCAL_	4.2V	± 25mV
Vchar	8.4V	± 40mV
Ichar	500mA	± 20mA
BSI	75k	± 1.3kohm
Btemp	273K(47k)	± 5K

Backup battery

Symptom of backup battery fault is

Real Time Clock loses the correct time during short main battery removal.

The same symptom can also be seen when the backup battery is empty. About 5 hours is needed to fully charge the backup battery in the device. NOTE: Backup battery is charged only the same time with main battery charging. Or when the device is LOCAL or TEST mode.

Always check the backup battery visually for any leakage or any other visual defect.

Check that the backup battery is correctly mounted in the device before closing the cover.

Check with Phoenix that backup battery is OK

Measure the voltage of backup battery

- Normal operation when the voltage is > 2.0V
- Fully charged when the voltage is about 3.2V (because of large internal impedance voltage won't stay above 3.0V a long time after charging is disabled)

Enable backup battery charging (start to charge main battery or boot device to LOCAL or TEST mode)

Measure voltage of backup battery during charging, It should arise if it is not 3.2V, yet.

When the voltage is over 2.0V for sure, check backup battery with Phoenix.
-> In not OK then D190 is faulty.

Ensure that the RTC is running.

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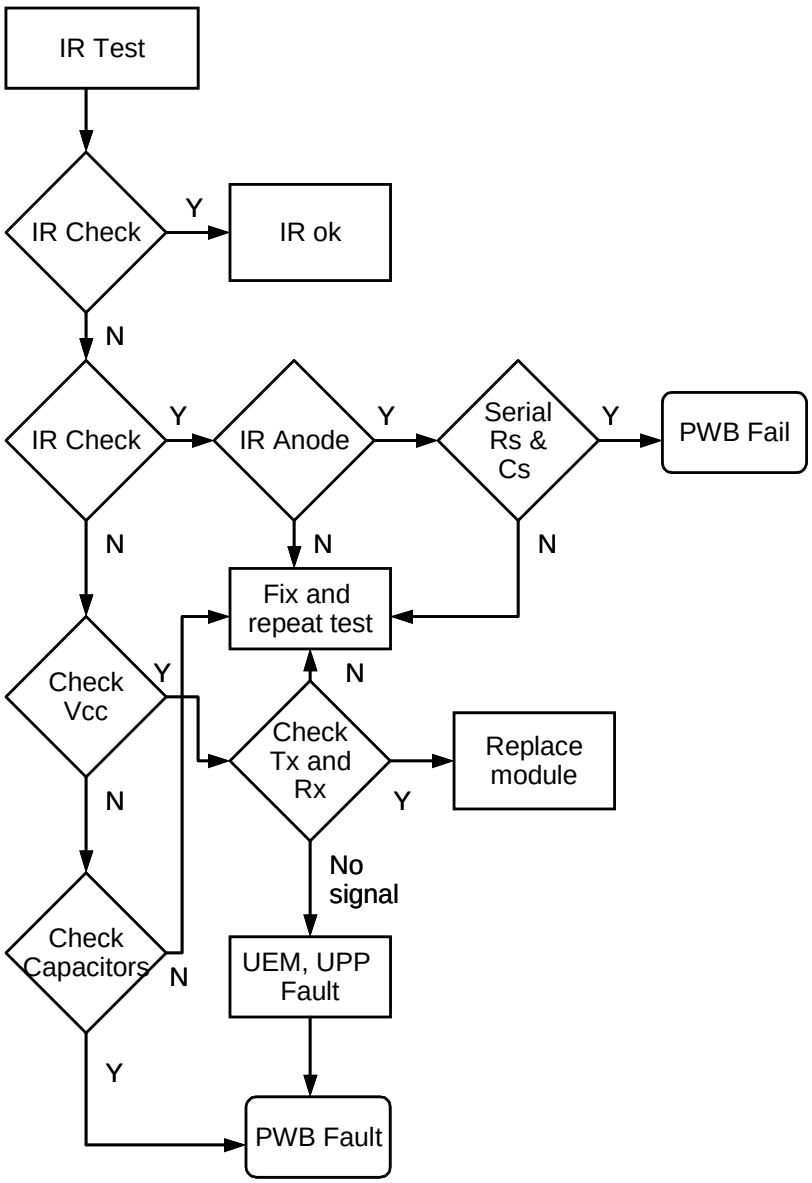
IR interface

At this point it is supposed that problem is in HW.



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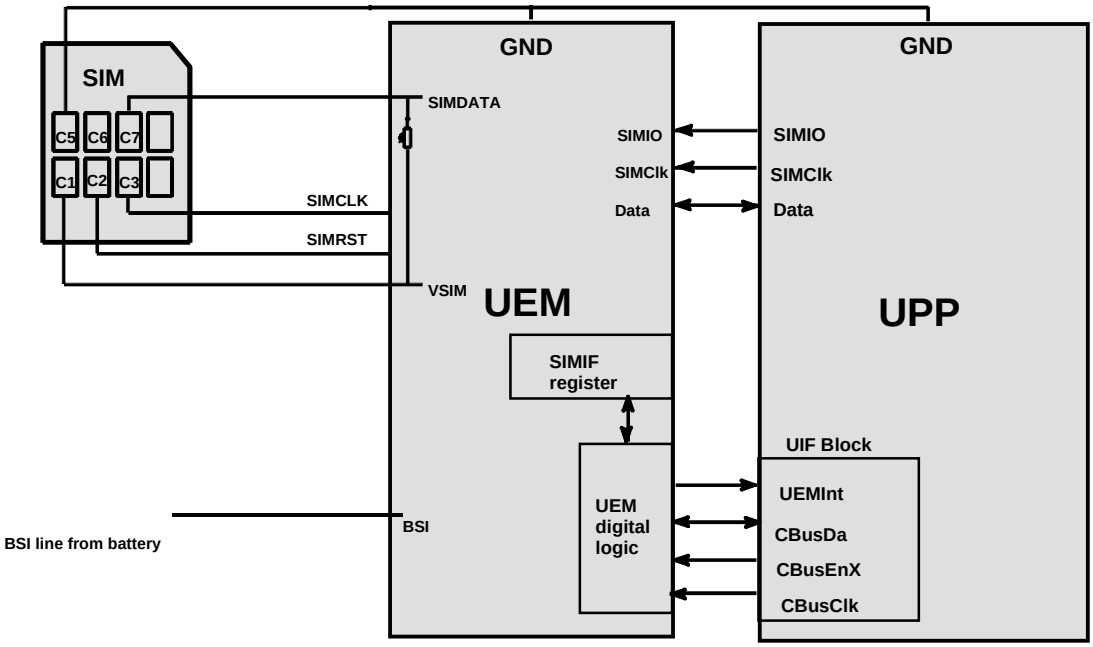
SIM card

The whole SIM interface locates in two chips UPP_WD2 and UEM. UEM contains the SIM interface logic level shifting. UPP provides SIMClk through UEM to the SIM. SIM interface supports both 3 V and 1.8 V SIMs.

UPP & UEM SIM connections



The SIM power up/down sequence is generated in the UEM. This means that the UEM generates the RST signal to the SIM. Also the SIMCardDet signal is connected to UEM. The card detection is taken from the BSI signal, which detects the removal of the battery. Monitoring of the BSI signal is done by a comparator inside UEM. The threshold voltage is calculated from the battery size specifications.

The SIM interface is powered up when the SIMCardDet signal indicates "card in". This signal is derived from the BSI signal. SW tries first to power up the SIM with 1.8 V. If this doesn't succeed power up is repeated with VSIM switched to 3 V.

The data communication between the card and the phone is asynchronous half duplex. The clock supplied to the card is in GSM system 1.083 MHz or 3.25 MHz. The data baudrate is SIM card clock frequency divided by 372 (by default), 64, 32 or 16.

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Figure 3: SIM Power Up.

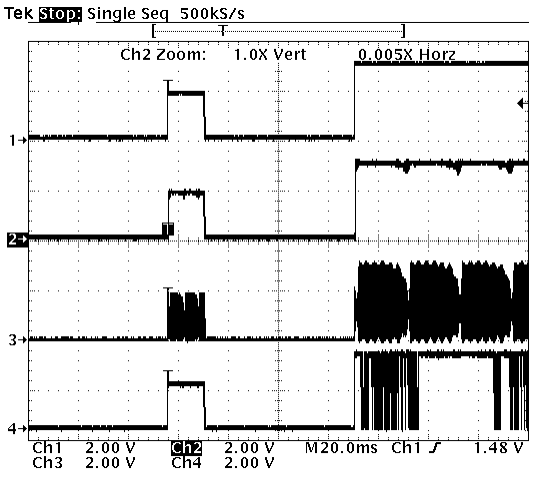

Figure 4: SIM answer to reset.

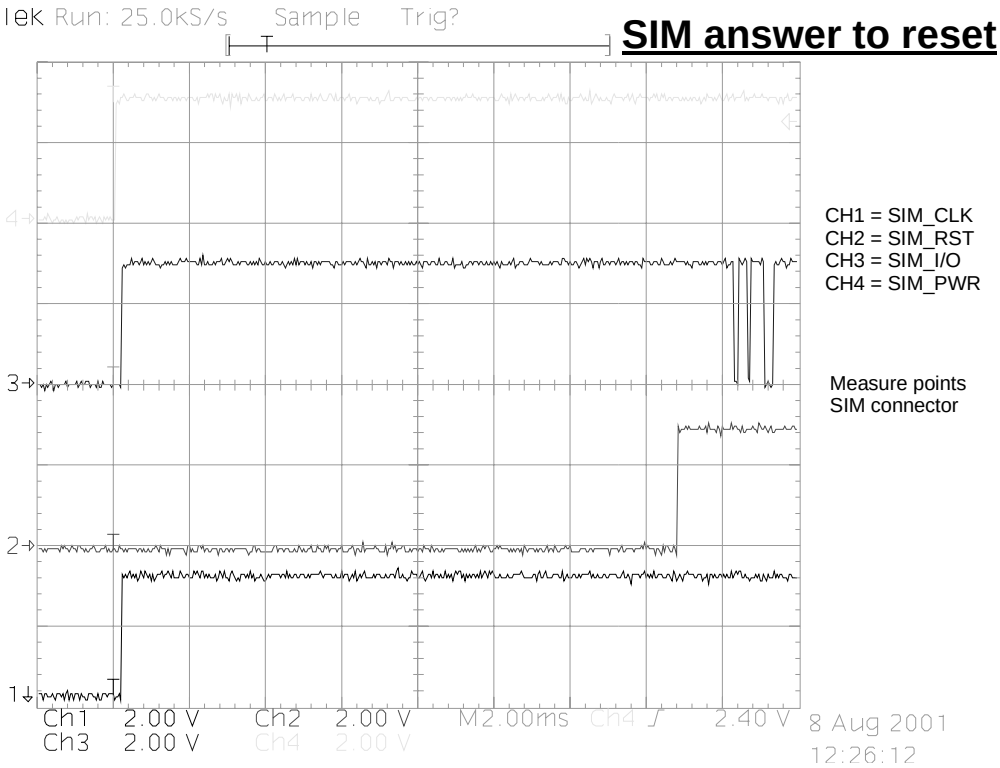

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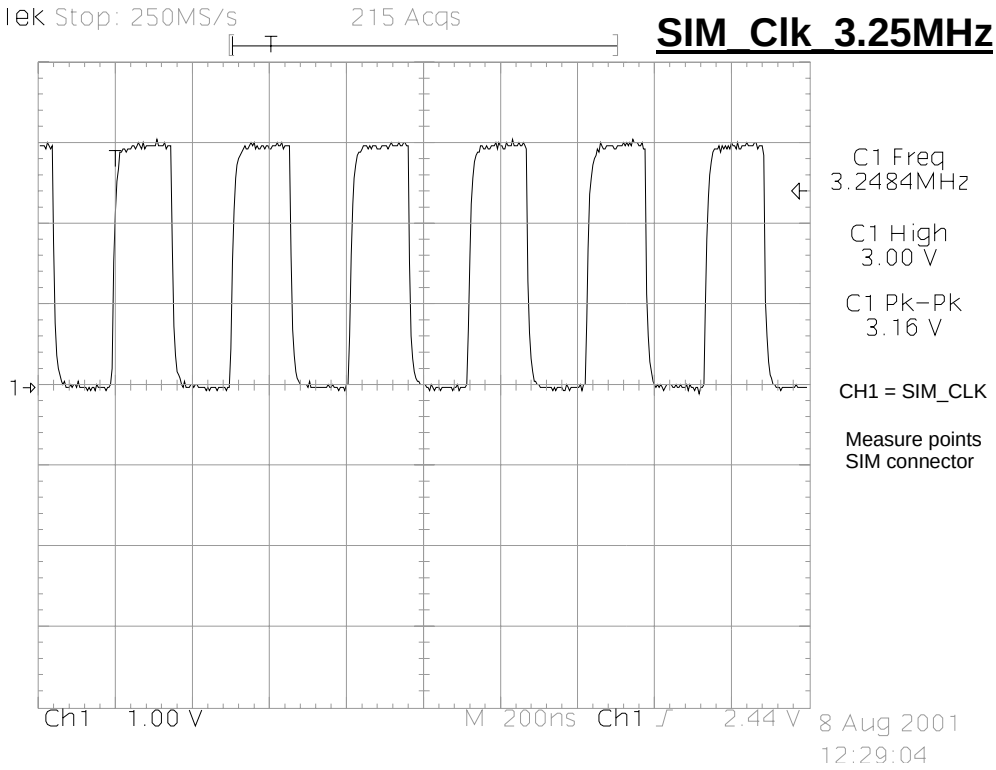
Figure 5: SIM Clk 3.25MHz.



Remember to check the two PHOENIX test cases before changing UPP!!!!

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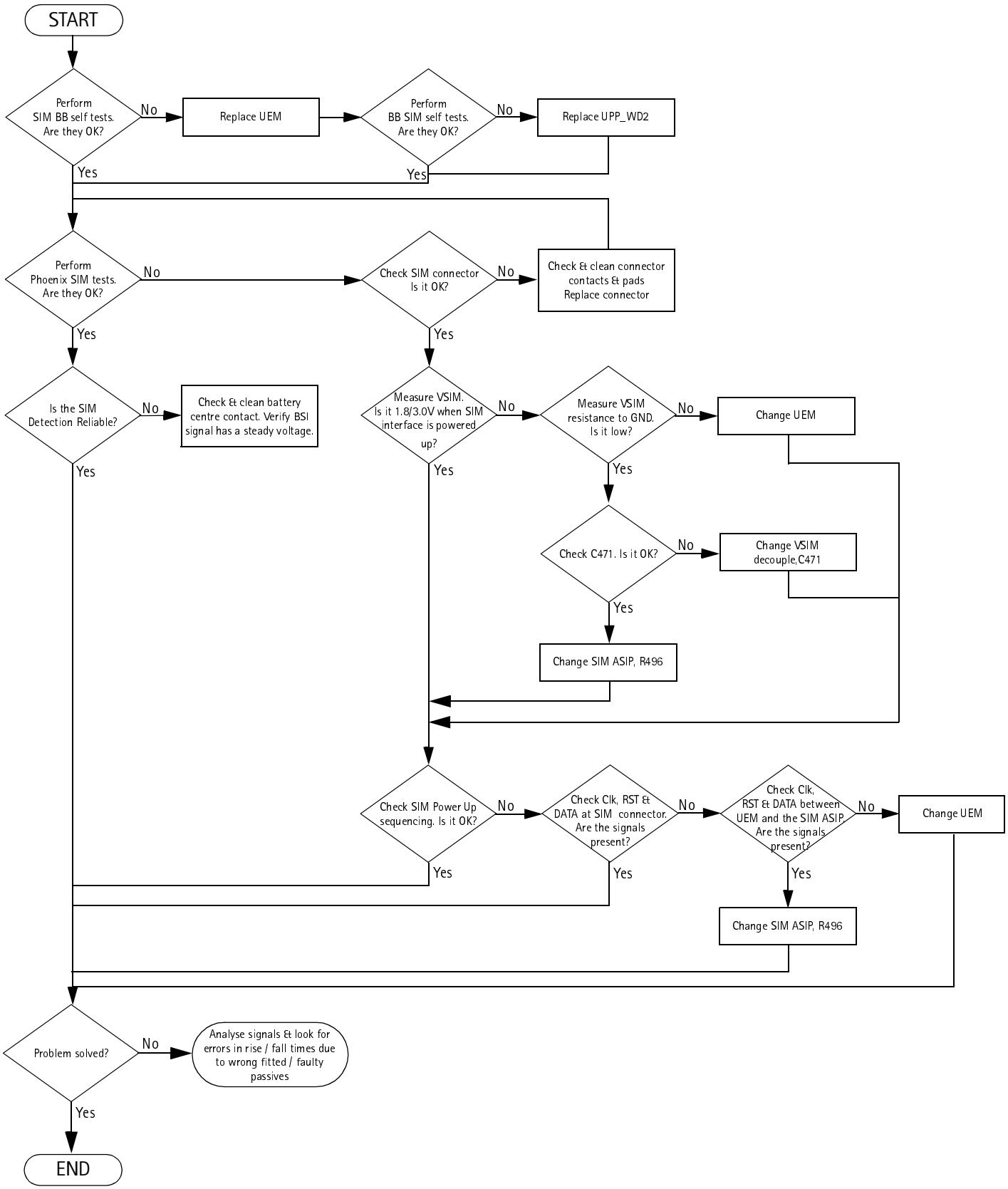
"Insert SIM Card" in device display although card is inserted



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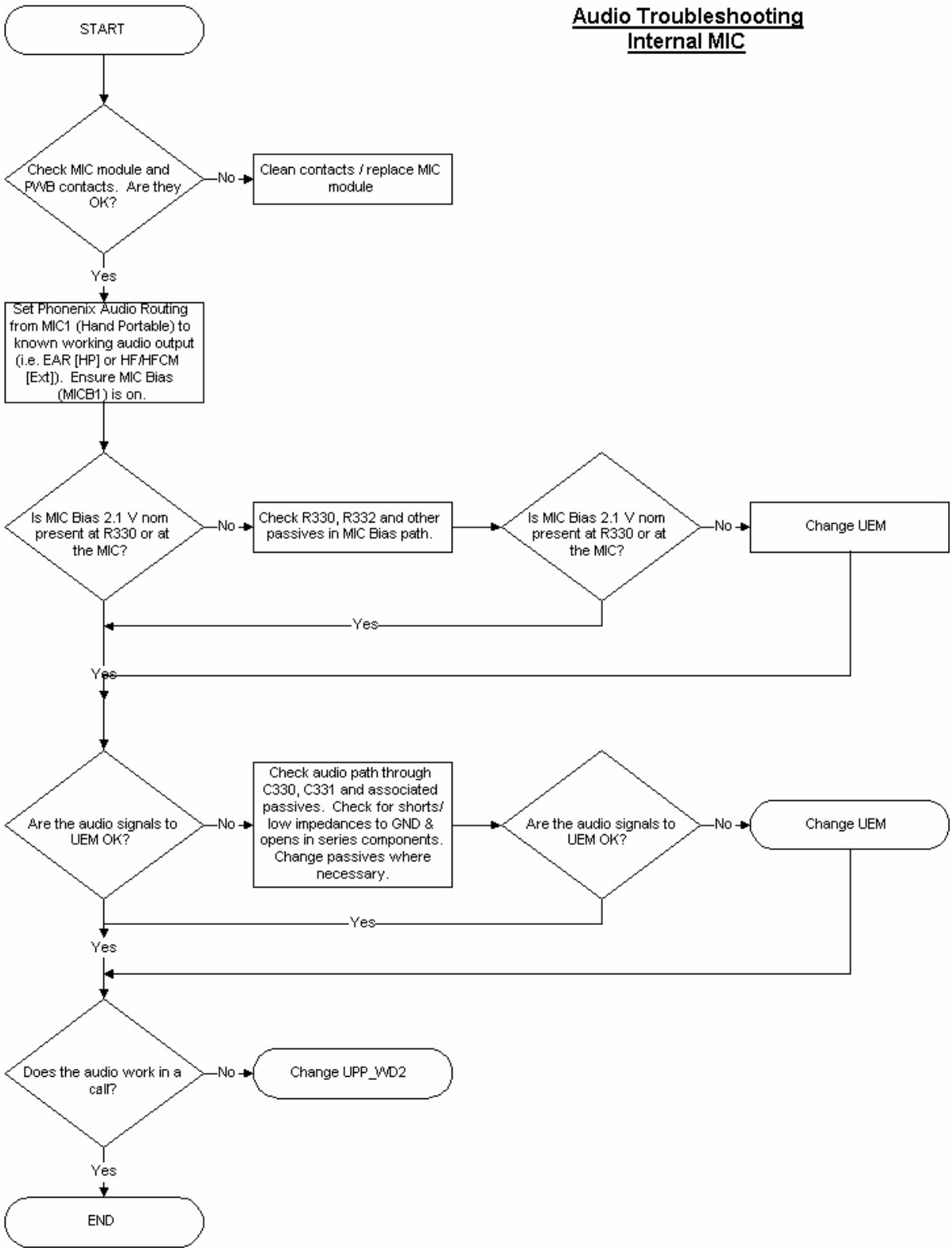
Audio troubleshooting

Microphone


Audio Troubleshooting
Internal MIC
START
Check MIC module and PWB contacts. Are they OK?
No
Clean contacts / replace MIC module
Yes
Set Phonenix Audio Routing from MIC1 (Hand Portable) to known working audio output (i.e. EAR [HP] or HF/HFCM [Ext]). Ensure MIC Bias (MICB1) is on.
Is MIC Bias 2.1 V nom present at R330 or at the MIC?
No
Check R330, R332 and other passives in MIC Bias path.
Is MIC Bias 2.1 V nom present at R330 or at the MIC?
No
Change UEM
Yes
Yes
Are the audio signals to UEM OK?
No
Check audio path through C330, C331 and associated passives. Check for shorts/ low impedances to GND & opens in series components. Change passives where necessary.
Are the audio signals to UEM OK?
No
Change UEM
Yes
Yes
Does the audio work in a call?
No
Change UPP_WD2
Yes
END

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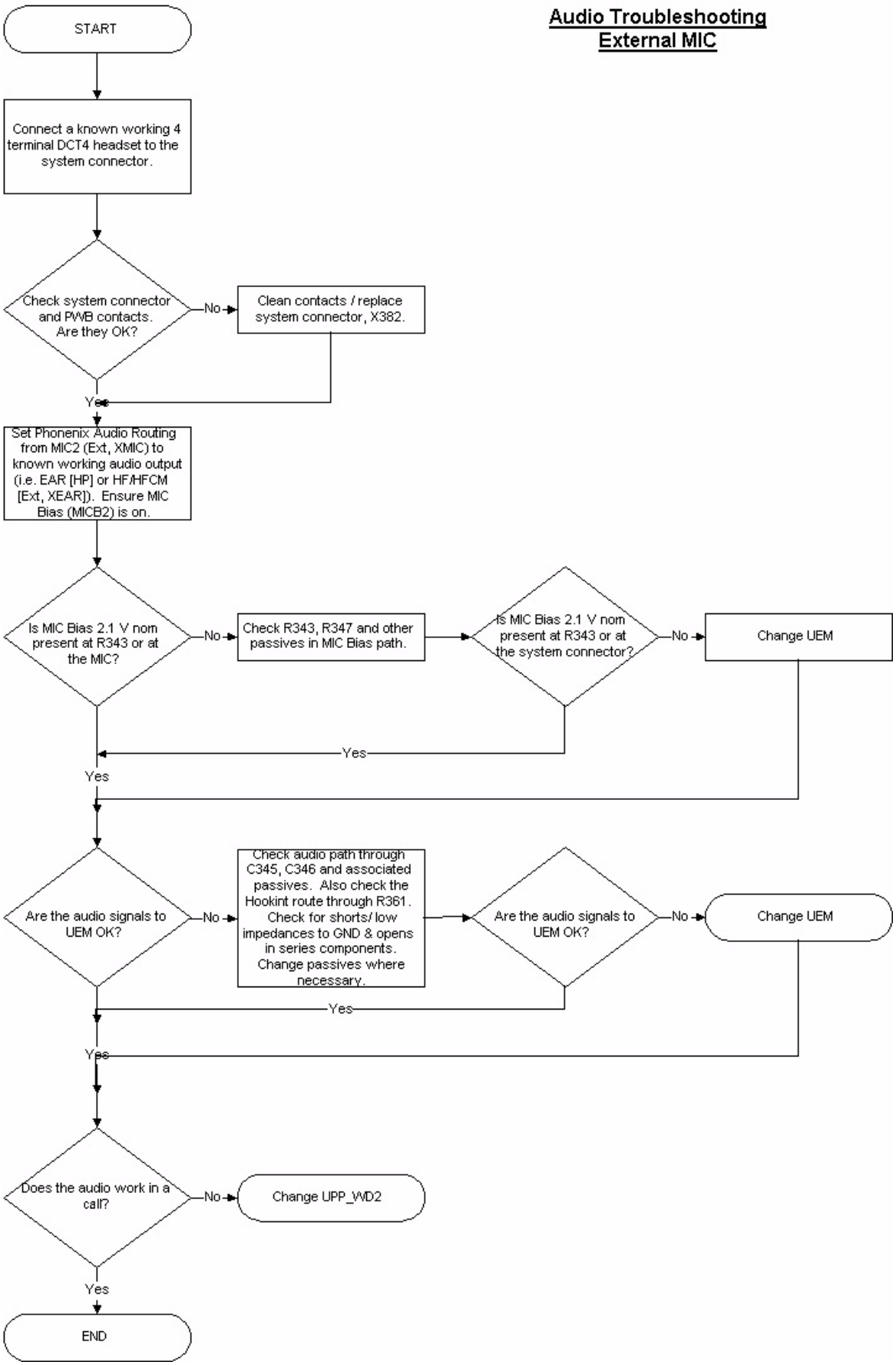
Audio Troubleshooting
External MIC
START
Connect a known working 4 terminal DCT4 headset to the system connector.
Check system connector and PWB contacts. Are they OK?
No
Clean contacts / replace system connector, X382.
Yes
Set Phonenix Audio Routing from MIC2 (Ext, XMIC) to known working audio output (i.e. EAR [HP] or HF/HFCM [Ext, XEAR]). Ensure MIC Bias (MICB2) is on.
Is MIC Bias 2.1 V nom present at R343 or at the MIC?
No
Check R343, R347 and other passives in MIC Bias path.
Is MIC Bias 2.1 V nom present at R343 or at the system connector?
No
Change UEM
Yes
Yes
Are the audio signals to UEM OK?
No
Check audio path through C345, C346 and associated passives. Also check the Hookint route through R361. Check for shorts/ low impedances to GND & opens in series components. Change passives where necessary.
Are the audio signals to UEM OK?
No
Change UEM
Yes
Yes
Does the audio work in a call?
No
Change UPP_WD2
Yes
END

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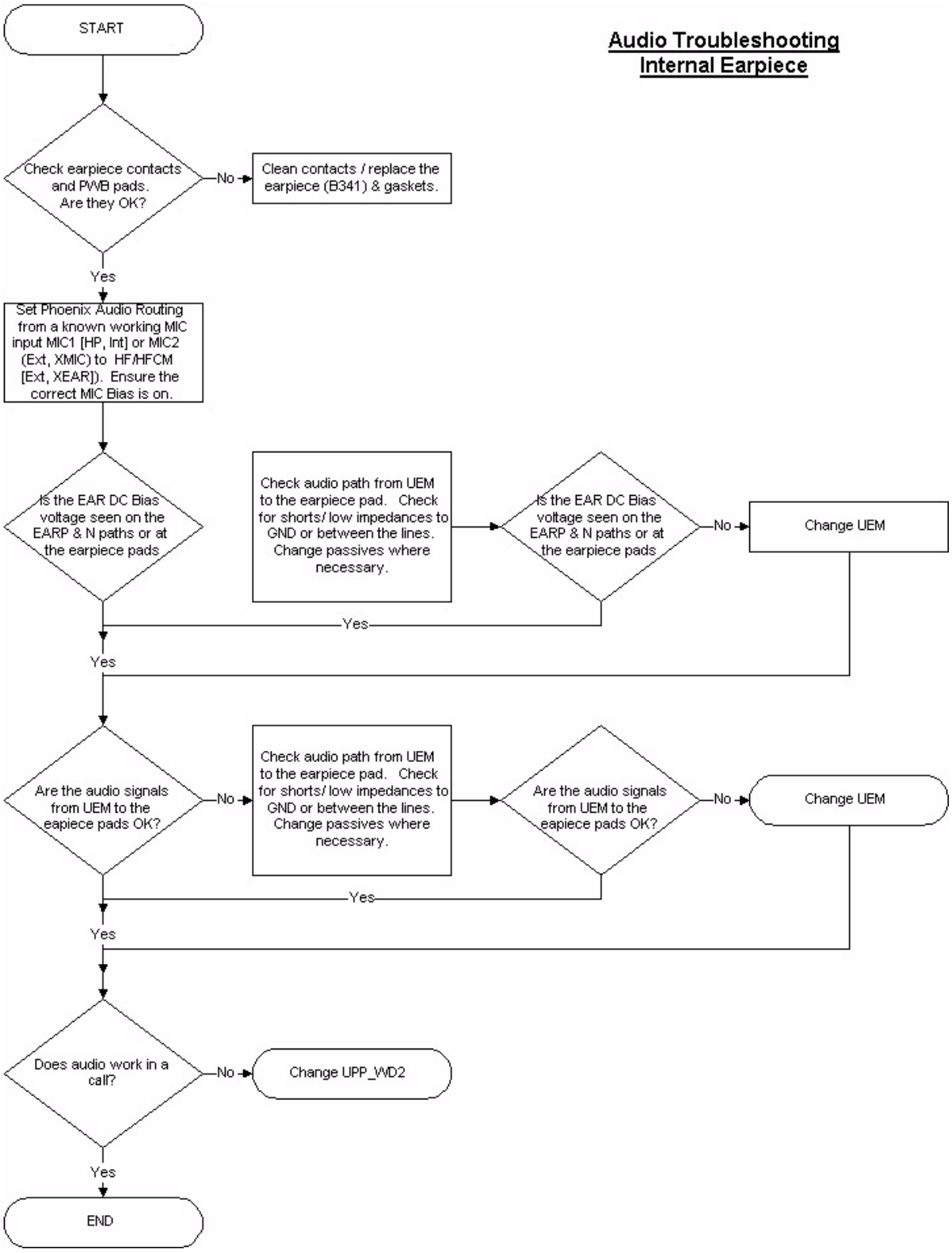
Earpiece

Check that holes are not coated.


Audio Troubleshooting
Internal Earpiece
START
Check earpiece contacts and PWB pads. Are they OK?
No
Clean contacts / replace the earpiece (B341) & gaskets.
Yes
Set Phoenix Audio Routing from a known working MIC input MIC1 [HP, Int] or MIC2 (Ext, XMIC) to HF/HFCM [Ext, XEAR]). Ensure the correct MIC Bias is on.
Is the EAR DC Bias voltage seen on the EARP & N paths or at the earpiece pads
Check audio path from UEM to the earpiece pad. Check for shorts/ low impedances to GND or between the lines. Change passives where necessary.
Is the EAR DC Bias voltage seen on the EARP & N paths or at the earpiece pads
No
Change UEM
Yes
Yes
Are the audio signals from UEM to the eapiece pads OK?
No
Check audio path from UEM to the earpiece pad. Check for shorts/ low impedances to GND or between the lines. Change passives where necessary.
Are the audio signals from UEM to the eapiece pads OK?
No
Change UEM
Yes
Yes
Does audio work in a call?
No
Change UPP_WD2
Yes
END

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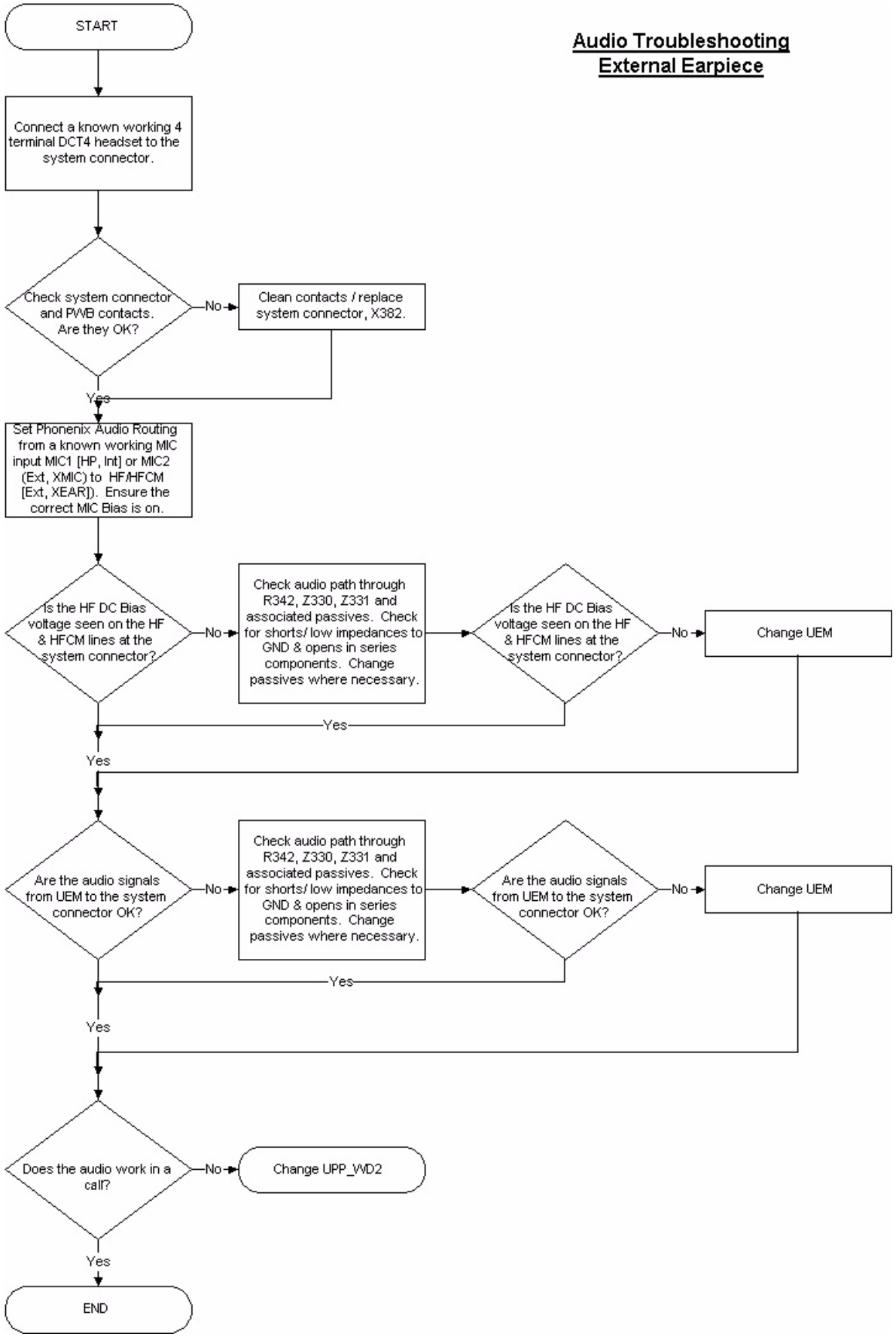
Audio Troubleshooting
External Earpiece
START
Connect a known working 4 terminal DCT4 headset to the system connector.
Check system connector and PWB contacts. Are they OK?
No
Clean contacts / replace system connector, X382.
Yes
Set Phonenix Audio Routing from a known working MIC input MIC1 [HP, Int] or MIC2 (Ext, XMIC) to HF/HFCM [Ext, XEAR]). Ensure the correct MIC Bias is on.
Is the HF DC Bias voltage seen on the HF & HFCM lines at the system connector?
No
Check audio path through R342, Z330, Z331 and associated passives. Check for shorts/ low impedances to GND & opens in series components. Change passives where necessary.
Is the HF DC Bias voltage seen on the HF & HFCM lines at the system connector?
No
Change UEM
Yes
Yes
Are the audio signals from UEM to the system connector OK?
No
Check audio path through R342, Z330, Z331 and associated passives. Check for shorts/ low impedances to GND & opens in series components. Change passives where necessary.
Are the audio signals from UEM to the system connector OK?
No
Change UEM
Yes
Yes
Does the audio work in a call?
No
Change UPP_WD2
Yes
END

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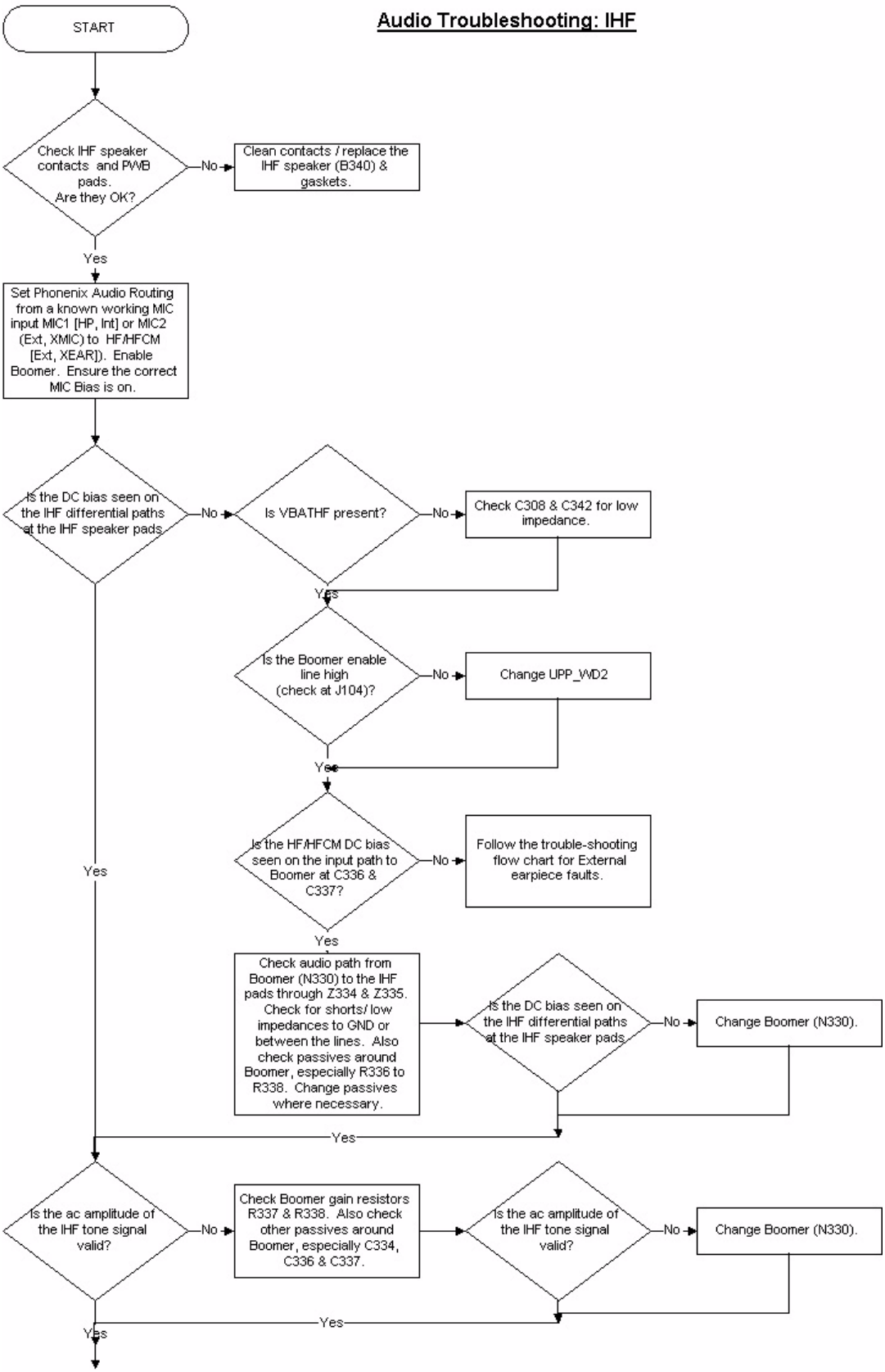
IHF


Audio Troubleshooting: IHF
START
Check IHF speaker contacts and PWB pads. Are they OK?
No
Clean contacts / replace the IHF speaker (B340) & gaskets.
Yes
Set Phonenix Audio Routing from a known working MIC input MIC1 [HP, Int] or MIC2 (Ext, XMIC) to HF/HFCM [Ext, XEAR]). Enable Boomer. Ensure the correct MIC Bias is on.
Is the DC bias seen on the IHF differential paths at the IHF speaker pads
No
Is VBATHF present?
No
Check C308 & C342 for low impedance.
Yes
Is the Boomer enable line high (check at J104)?
No
Change UPP_WD2
Yes
Is the HF/HFCM DC bias seen on the input path to Boomer at C336 & C337?
No
Follow the trouble-shooting flow chart for External earpiece faults.
Yes
Yes
Check audio path from Boomer (N330) to the IHF pads through Z334 & Z335. Check for shorts/ low impedances to GND or between the lines. Also check passives around Boomer, especially R336 to R338. Change passives where necessary.
Is the DC bias seen on the IHF differential paths at the IHF speaker pads
No
Change Boomer (N330).
Yes
Is the ac amplitude of the IHF tone signal valid?
No
Check Boomer gain resistors R337 & R338. Also check other passives around Boomer, especially C334, C336 & C337.
Is the ac amplitude of the IHF tone signal valid?
No
Change Boomer (N330).
Yes
Yes

See the following flow chart

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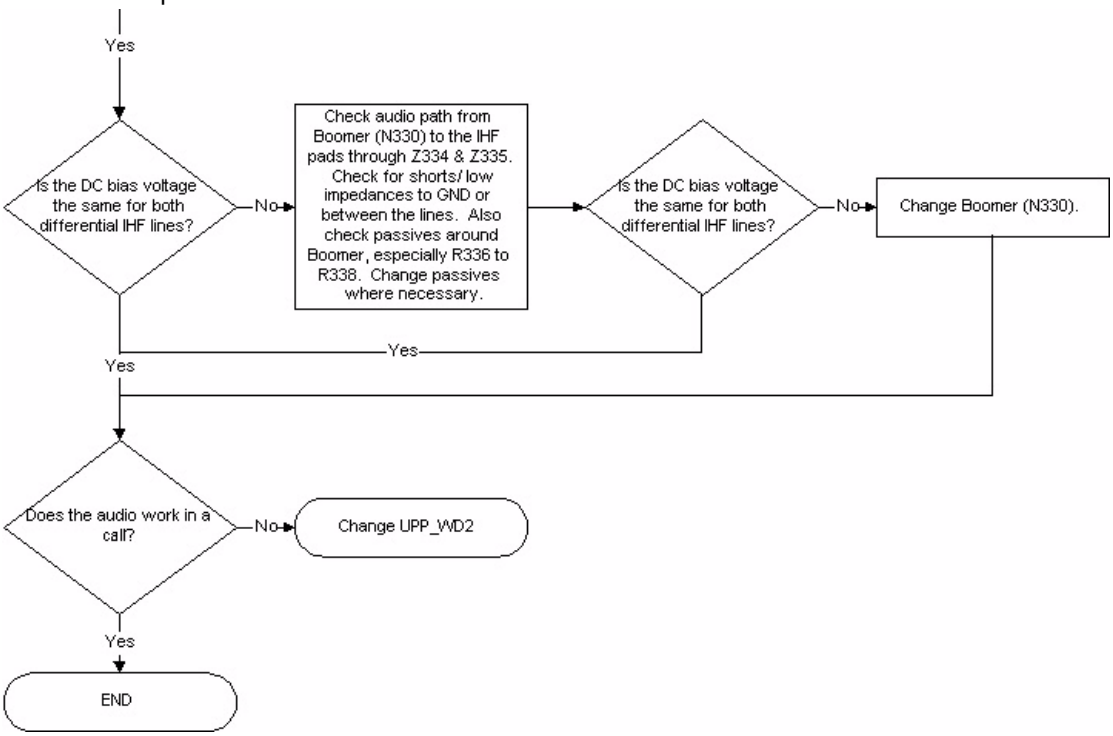
See the previous flow chart


Yes
Is the DC bias voltage the same for both differential IHF lines?
No
Check audio path from Boomer (N330) to the IHF pads through Z334 & Z335. Check for shorts/ low impedances to GND or between the lines. Also check passives around Boomer, especially R336 to R338. Change passives where necessary.
Is the DC bias voltage the same for both differential IHF lines?
No
Change Boomer (N330).
Yes
Yes
Does the audio work in a call?
No
Change UPP_WD2
Yes
END

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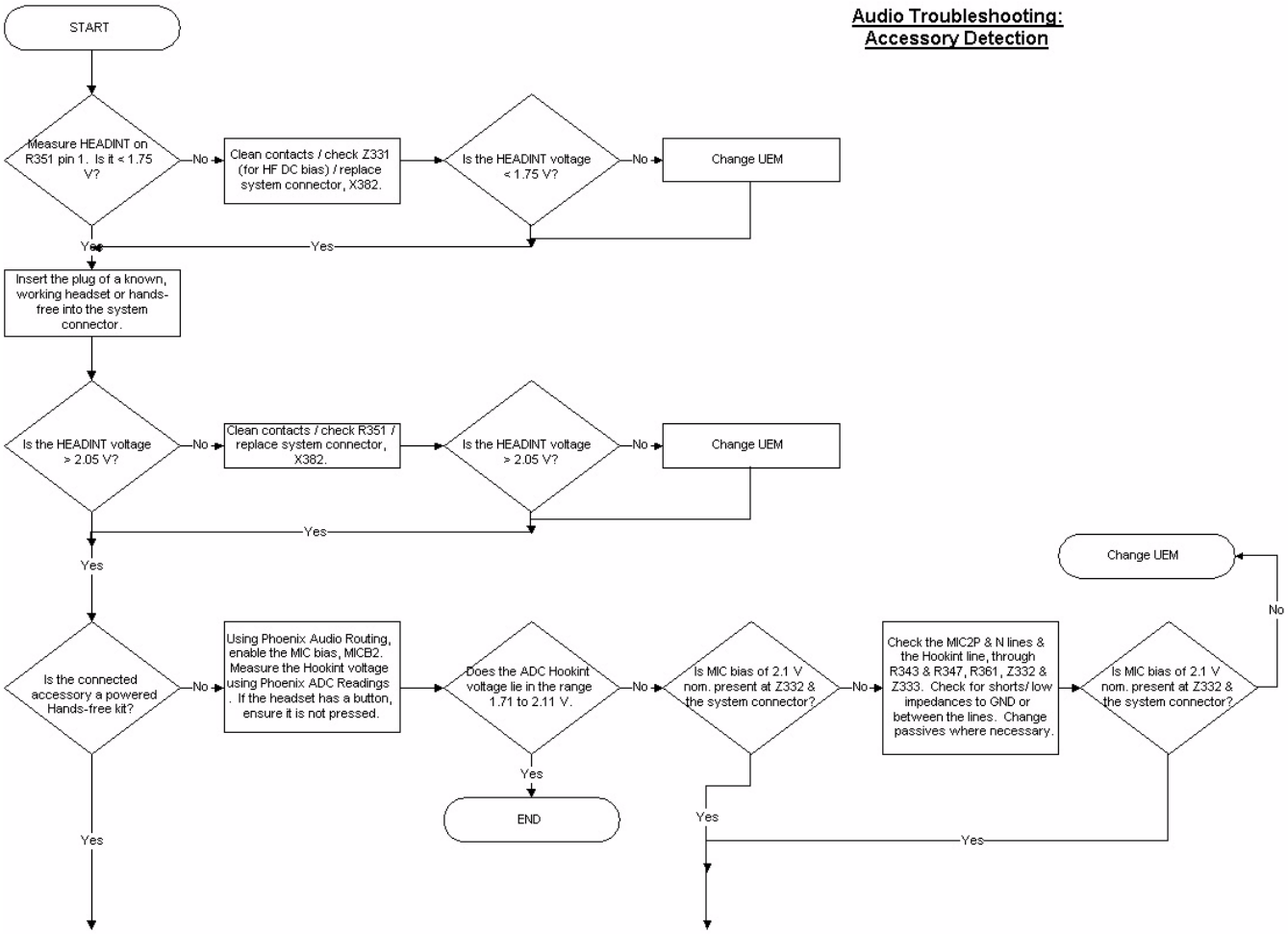
Accessory detection troubleshooting



See the following flow chart.

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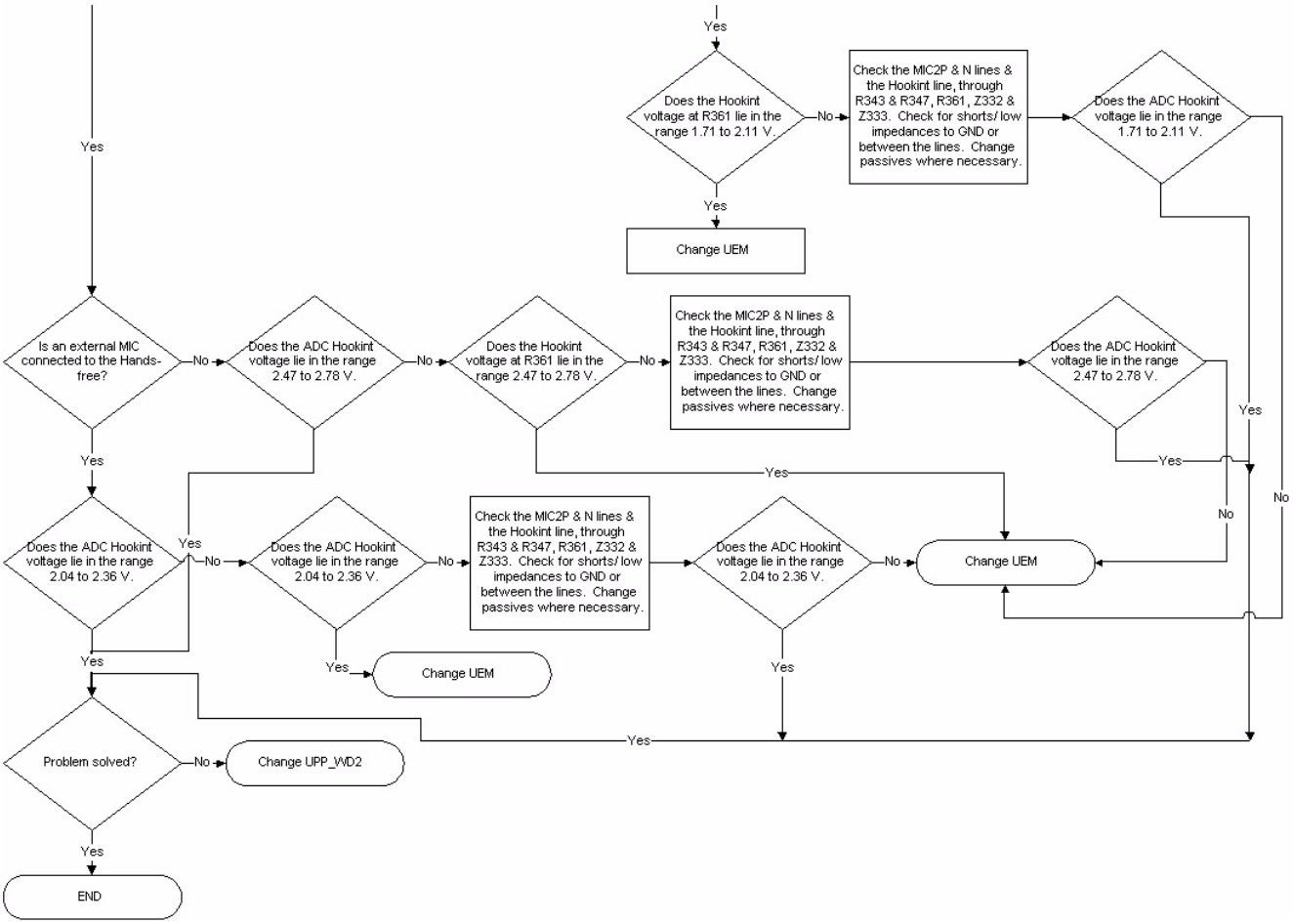
See previous flow chart.


Yes
Does the Hookint voltage at R361 lie in the range 1.71 to 2.11 V.
No
Check the MIC2P & N lines & the Hookint line, through R343 & R347, R361, Z332 & Z333. Check for shorts/ low impedances to GND or between the lines. Change passives where necessary.
Does the ADC Hookint voltage lie in the range 1.71 to 2.11 V.
Yes
Change UEM
Yes
Is an external MIC connected to the Hands-free?
No
Does the ADC Hookint voltage lie in the range 2.47 to 2.78 V.
No
Does the Hookint voltage at R361 lie in the range 2.47 to 2.78 V.
No
Check the MIC2P & N lines & the Hookint line, through R343 & R347, R361, Z332 & Z333. Check for shorts/ low impedances to GND or between the lines. Change passives where necessary.
Does the ADC Hookint voltage lie in the range 2.47 to 2.78 V.
Yes
Yes
Yes
Yes
No
Does the ADC Hookint voltage lie in the range 2.04 to 2.36 V.
Yes
No
Does the ADC Hookint voltage lie in the range 2.04 to 2.36 V.
No
Check the MIC2P & N lines & the Hookint line, through R343 & R347, R361, Z332 & Z333. Check for shorts/ low impedances to GND or between the lines. Change passives where necessary.
Does the ADC Hookint voltage lie in the range 2.04 to 2.36 V.
No
Change UEM
Yes
Yes
Change UEM
Yes
Problem solved?
No
Change UPP_WD2
Yes
Yes
END

Memory troubleshooting

Most memory related errors are found through flashing the device, flashing the device is therefore recommended before any of the steps described in this chapter. Check flashing troubleshooting section first.

There are however a few memory related errors that cannot be found through flashing.

- - SDRAM(D312) partially damaged. This can mean that the SDRAM component itself is partially damaged and all the memory locations cannot be successfully read or there is a soldering problem somewhere either under UPP or SDRAM. There is a BB self test for testing SDRAM component quite thoroughly, but the problem is that if SDRAM doesn't function properly one may not be able to run those tests as SDRAM is used during the device boot and selftest cannot be run if the device hasn't booted.
- DEVICE may inform about being "out of memory " more often than it should
- - flash1 (D310) is partially/totally damaged. During flashing the manufacturer, device and revision id's are read, but flashing is done based on id's of the flash0 (D311). This means that one cannot see any error messages displayed on Phoenix window during flashing if flash1 is failing. Id's are however displayed on the Phoenix window and successful read of flash1 id's can be checked from there.

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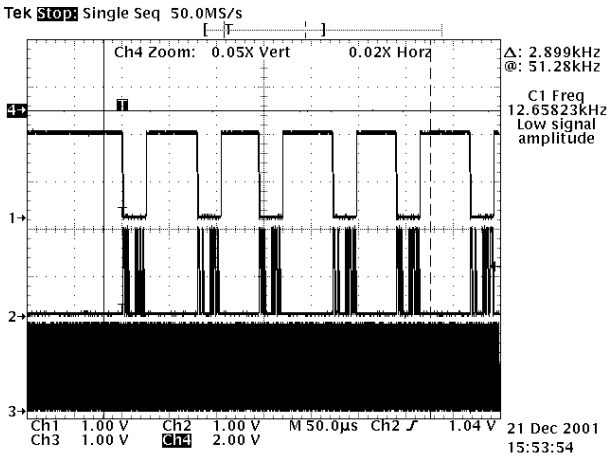
Serial interface trouble shooting

CBUS

CBUS is a three wire serial interface between the main baseband components. The bus consists of data, clock and bus_enable signals. In NHM-10 the bus is connected from UPP WD2 to ZOCUS, UEM and LPRF. UPP_WD2 takes care of controlling the traffic on the bus.

If the interface is faulty from the UPP WD2's end the phone won't boot properly as powering configurations don't work. Traffic on the bus can be monitored from three pins on the LPRF module. Pins 34, 35 and 36.

In the pictures below CBUS traffic at bootup is shown. CbusEnx is connected to Ch1, Cbus Da to Ch2 and CbusClk to Ch3.



If however you are able to get the phone to boot up and can reach Phoenix BB self tests it is possible to test the functionality of each component attached to Cbus. Use

ST_ZOCUS_CBUS_IF_TEST to test AEM Cbus interface

ST_UEM_CBUS_IF_TEST to test UEM Cbus interface

ST_LPRF_IF_TEST to test Bluetooth Cbus interface

If an error is found testing any of the above components you should replace the failing component.

FBUS

FBUS is a two wire RX and TX interface between UPP and flash/test interface. The bus goes through UEM which adjusts the voltage levels to suit UPP_WD2. The interface voltage level on the phone flash/test pad pattern is 2.78V and on the UPP WD2 end it is 1.8V. The functionality of this interface should not affect the device boot into NORMAL, LOCAL nor TEST modes. Phoenix tests can be performed through MBUS interface in the case of a failure in FBUS interface. Flashing is not possible if there is a problem in FBUS.

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MBUS

MBUS is a two wire RX and TX interface between UPP and UEM. From UEM the interface continues to flash/test interface as a one wire interface. UEM also adjusts the voltage levels. The interface voltage level on the phone flash/test pad pattern is 2.78V and on the UPP WD2 end it is 1.8V. MBUS traffic between UPP WD2 and UEM can be tested with PHOENIX (ST_MBUS_RX_TX_LOOP_TEST). Flashing is not possible if there is a problem in MBUS.

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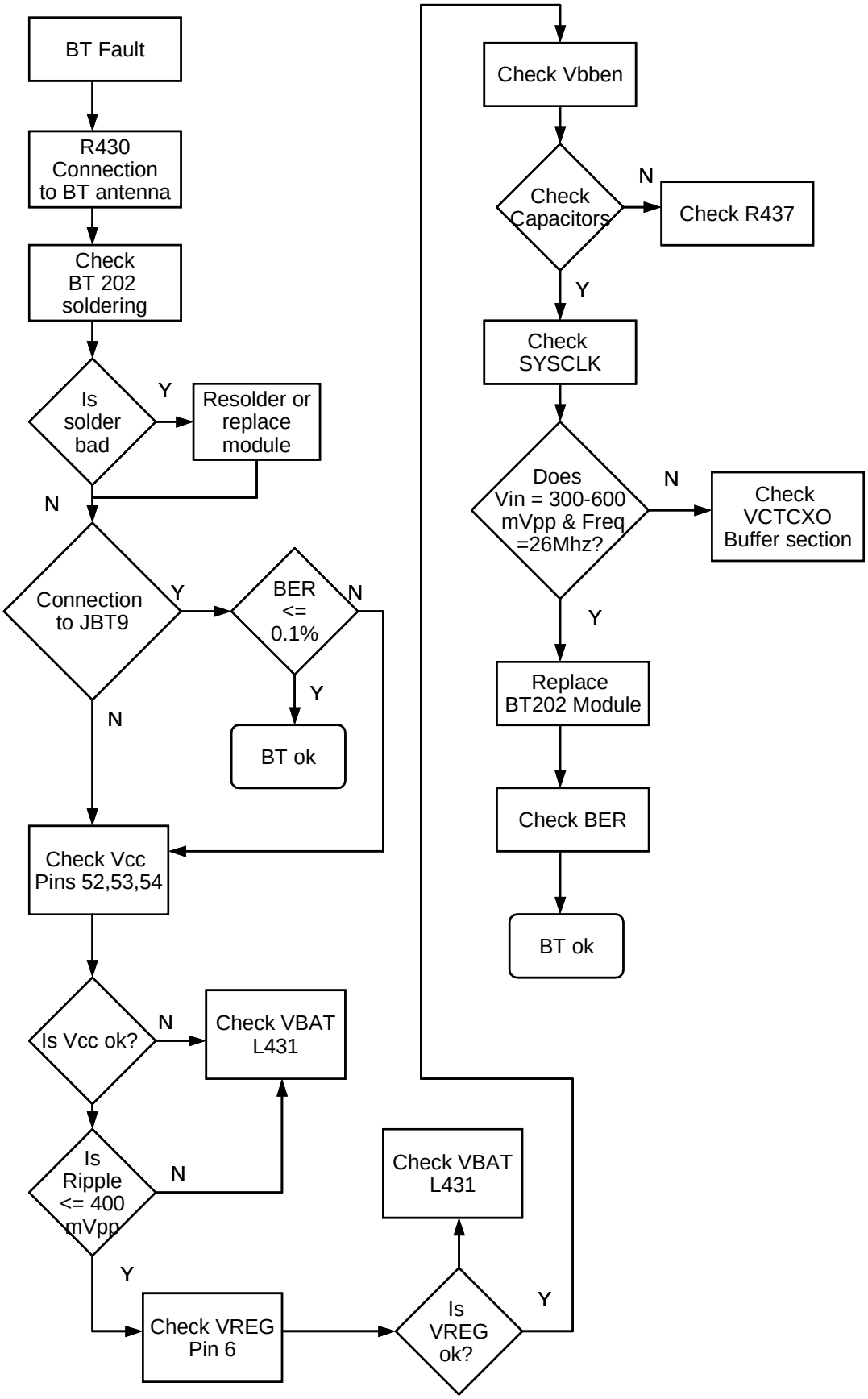
Bluetooth troubleshooting



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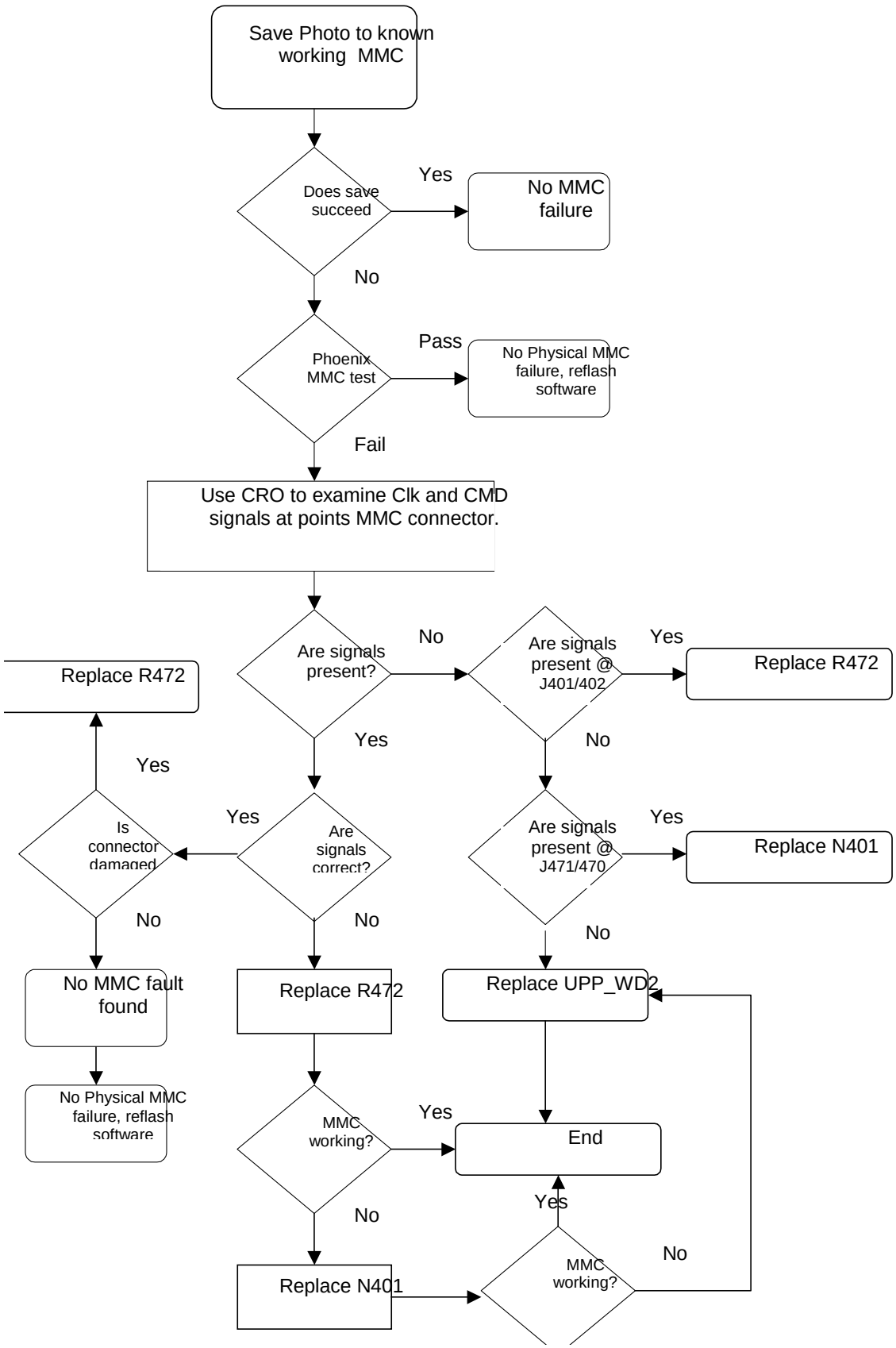
MMC troubleshooting



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Camera Module Troubleshooting

A fault associated to camera operation can be roughly categorized to three subgroups:

1. Camera is not functional at all, no image can be obtained

2. Images can be taken but there is nothing recognizable in them

3. Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded

Type 1 and 2 faults are most often similar to what traditionally has been found in any electronic devices. Type 3 faults are new to NMP and maybe the most challenging to find and verify.

Image quality is very hard to measure quantitatively, and even comparative measurements are difficult (comparing two images) if the difference is small. Especially if the user is not satisfied with his/her devices' image quality, and tells e.g. that the images are not sharp, it is very difficult to test the device and get an exact figure which then would tell if the device is OK or not.

Most often, subjective evaluation has to be used for finding out if a certain property of the camera is acceptable or not. Some training and a correctly operating reference device may be needed in order to detect what actually is wrong, or is there anything wrong at all. It is easy for the user to take bad looking images in bad conditions; thus the camera operation has to be checked always in constant conditions (lighting, temperature) or by using a second, known to be good device as a reference. Experience significantly helps in analyzing image quality.

Terms

Dynamic range: camera's ability to capture details in dark and bright areas of the scene simultaneously.

Exposure time: camera modules use silicon sensor to collect light and for forming an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to the light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter image. The operation principle is exactly the same with silicon sensor, but the shutter functionality is handled electronically i.e. there is no mechanical moving parts like in film cameras.

Flicker: Phenomena, which is caused by pulsating in scene lighting, typically appearing as wide horizontal stripes in image.

Noise: Variation of response between pixels with same level of input illumination. See e.g. Figure 9, "Noisy image taken in +70 deg C," on page 43 for example of noisy image.

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Image taking conditions effect on image quality

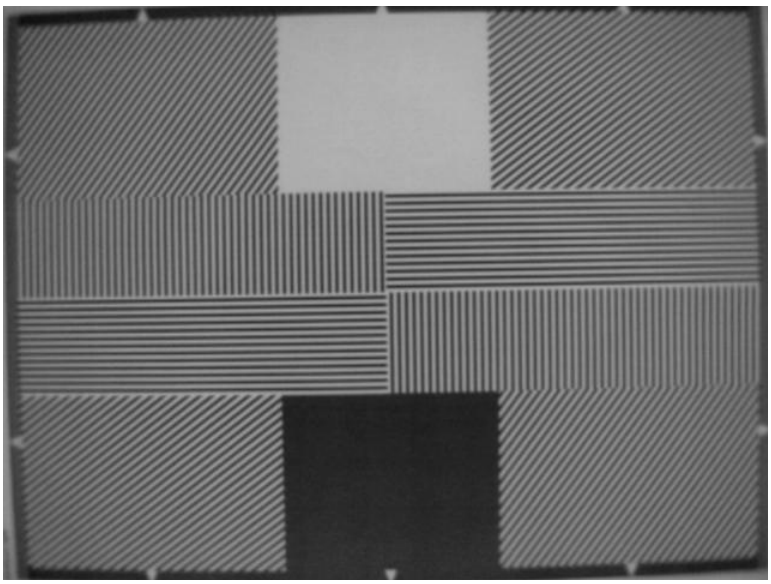
This chapter lists some of the factors, which may cause poor image quality if not taken into account, and thus result in complaints from customers.

Several issues affect the image quality and will need to be taken into account when shooting pictures; the listed items are normal to camera operation:

Distance to target: the lens in the module is specified to operate satisfactorily from 30 cm to infinite distance of scene objects. In practice, the operation is such that close objects may be noticed to get more blurred when distance to them is shortened from 40 cm. Lack of sharpness will be first visible in full resolution (VGA) images. If observing just the viewfinder, even very close objects may seem to appear sharp.

Sharpness of picture edges: lens performance degrades in image edges, and generally the image is sharpest in center part. Particularly this applies to distant objects (> 1 meter). See below.

Figure 6: Sharpness of picture is worse in edges than in center



Geometrical distortion: camera lens will cause some amount of so called barrel distortion in images. In practice, this appears as bending of straight objects in edges of the image. See the following picture. Note geometrical barrel distortion in background for example (wall in the background).

Amount of light available: in dim conditions camera runs out of sensitivity. Exposure time is long (especially in night mode) and the risk of getting shaken images grows. Image noise level grows. The maximum exposure time in night mode is approximately ¼ seconds, so images need to be taken with extreme care when the amount of light reflected from the target is low.

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Figure 7: shaking hands caused blurring of this image. Note geometrical barrel distortion in background

Movement in bright light: If pictures of moving objects are taken or if the device is used in a moving car, object 'skewing' or 'tilting' will occur. This phenomena is fundamental to most CMOS camera types and normal, and can not be helped. Movement of camera or object will usually cause blurring in inside or dim lighting conditions due to long exposure time.

Figure 8: Near objects in image get skewed when shooting from a moving car

Temperature: high temperatures inside the mobile phone will cause more noise to appear in images, e.g. in +70 degrees of celsius the noise level may be very high, and it further grows if the conditions are dim. This is also normal to camera operation. (See Figure 9, “Noisy image taken in +70 deg C,” on page 43)

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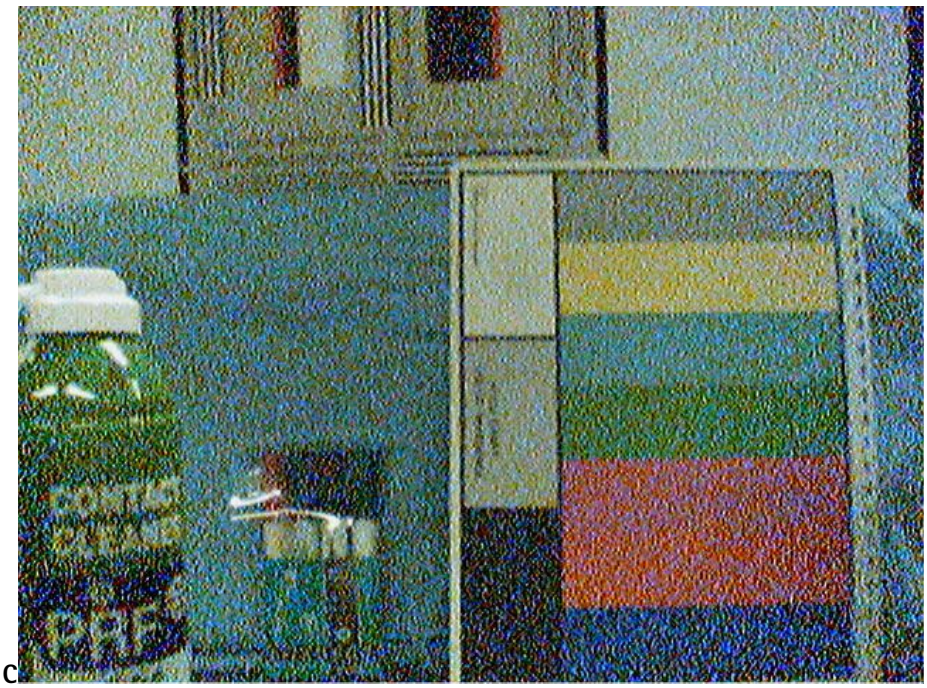
Figure 9: Noisy image taken in +70 deg



C

Display: if the display contrast is set too dark, the image quality degrades quite much: the images may be very dark, naturally depending on the setting. This flaw is easily cured by setting the display contrast to correct value.

Basic rules of photography, especially shooting against light: electronic image sensors typically have much lower dynamic range than films. In practice this means that when taking a picture inside e.g. having a window behind object, will produce poor results.

Figure 10: Image which has been taken "against the light". The actual object (a squirrel) can not be seen well.

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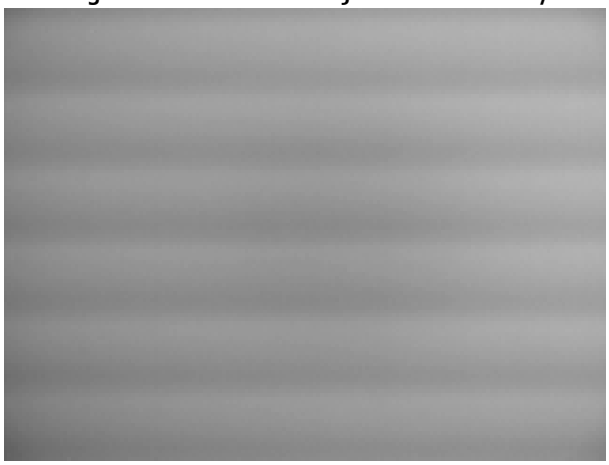
Flicker: in some rare occasions a very bright fluorescent light may cause flicker to be seen in the viewfinder image.

Figure 11: Flicker in image of white uniform object illuminated by strong fluorescent light



Bright light outside of image view: Especially sun can cause clearly visible 'halo' effects and poor contrast in images. This happens due to unwanted reflections inside camera optics.

Figure 12: A lens reflection effect caused by sun shining above the scene

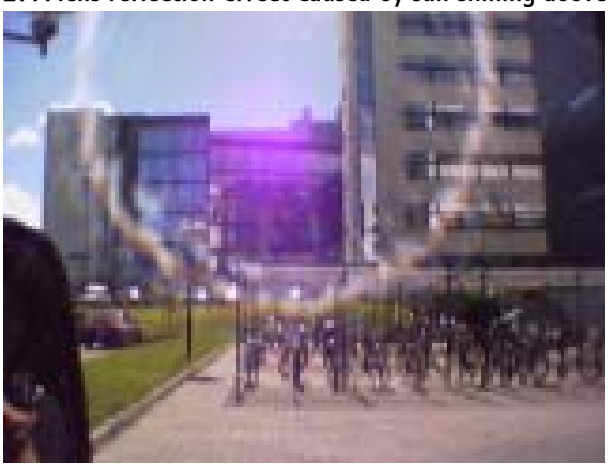


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Figure 13: A good quality picture taken indoors

Note: The camera module as a component is not a repairable part i.e. components in the module may not be changed. Cleaning dust from the front face is the only allowable operation.

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Image quality analysis

Possible faults in image quality

When checking for possible errors in camera functionality, knowing what error is suspected will significantly help the testing by narrowing down the amount of test cases. The following types of image quality problems may be expected to appear (in order of appearance probability):

Dust (black spots)

Lack of sharpness

Bit errors

In addition, there are many other kinds of possibilities for getting bad image quality, but those are ruled out from the scope of this document since probability of their appearance is going to be minimized by production testing.

Testing for dust

For detecting this kind of problems, take an image of uniform white surface and analyze it in full resolution; search carefully – finding these defects is not always easy. Figure 10. Effects of dust in optical path is an example of image containing easily detectable dust problems.

Black spots in image are caused by dirt particles trapped into the optical system: clearly visible and sharp edged black dots in image are typically dust particles on image sensor. These spots are searched for in manufacturing phase, but it is possible that the lens holder cavity contains a particle, which may move onto the image sensor active surface, e.g. when the phone is dropped. Thus it is also possible that the problem will disappear before the phone is brought to service. The camera should be replaced if it has been in some phase *verified* that the problem has been present.

If dust particles are located on infrared filter surface on either side, they are much harder to locate because they will be out of focus, and appear in image as large, grayish and fading-edge 'blobs'. Sometimes they will be very hard to find, and thus the user probably will not notice them at all since they do no harm. But it is possible that a larger particle disturbs the user, causing need for service.

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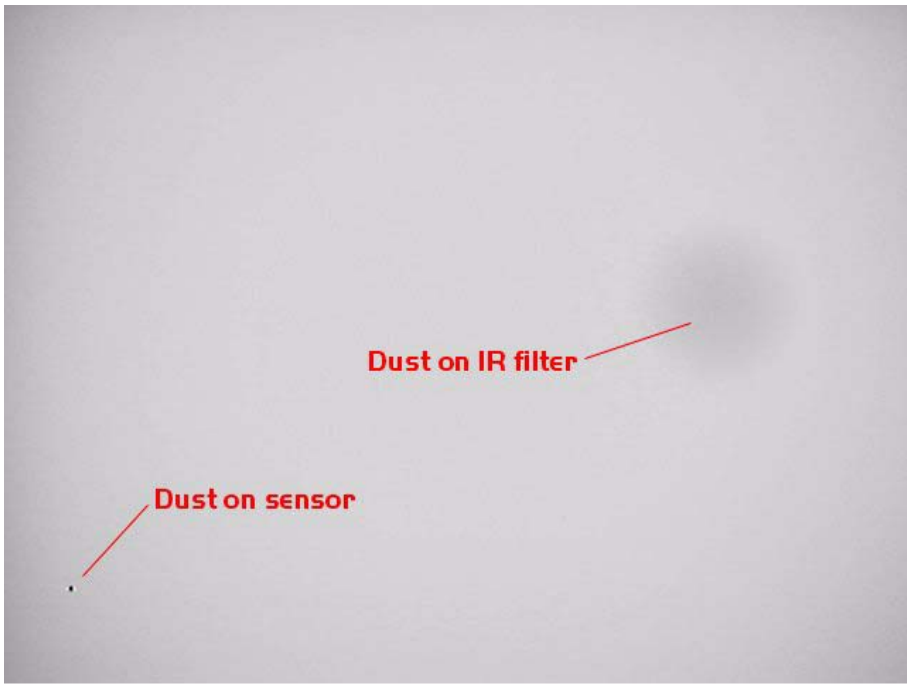

Figure 10. Effects of dust in optical path

If large dust particles get trapped on top of the lens surface in the cavity between camera window and lens, they will cause image blurring and poor contrast (see also item 'sharpness'). The seal between the window and lens should prevent any particles from getting into the cavity after manufacturing phase.

If dust particles are found on sensor or are suspected to be inside the camera module, this is classified as a manufacturing error of the module and thus the camera should be replaced. The particles inside the cavity between window and lens are most probably been trapped there in assembly phase in Nokia factory. It is of course also possible that the user has disassembled the device and caused the problem. However, in most cases it should be possible to remove the particle(s) by using compressed air. Never wipe the lens surface before trying compressed air; the possibility of damaging the lens is substantial. Always check the image sharpness after removing dust.

Testing for sharpness

If pictures taken with some device are claimed to be blurry, there are four possible sources for the claim:

User has tried to take pictures in too dark conditions and images are blurred due to handshake or movement. This is no cause to replace camera module

There is dirt between back window and camera lens

The back window is defective (somehow passed through window manufacturer's inspection). Window should be changed

Back window is visibly scratched, broken or dirty

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Camera lens is misfocused

Quantitative analysis of sharpness is very difficult to conduct in other than optics laboratory environment. Thus subjective analysis should be used.

If no visible defects (items 2-4) can be found, a couple of test images should be taken and checked. Generally, a well illuminated typical indoor office scene, such as the one in Figure 13, "A good quality picture taken indoors," on page 45, can be used as a target. The main considerations are:

Amount of light: 300 – 600 lux (bright office lighting) is sufficient

The scene should contain e.g. small objects for checking sharpness and distance to them should be in order of 1 – 2 meters

If possible, compare the image to another image of the same scene, taken by different device

The taken images should be analyzed on PC screen at 100% scaling simultaneously with reference image. Pay attention to the computer display settings; at least 65000 colors (16 bit) have to be used. 256 (8-bit) color setting is not sufficient, and true color (24 bit, 16 million colors) or 32 bit (full color) setting is recommended.

If there appears to be a clearly noticeable difference between the reference image and the test images, the module might have misfocused lens. In this case, the module should be changed. Always re-check the resolution after changing the camera. If a different module produces the same result, the fault is probably in camera window. Check the window by seeing through it when replacing the module.

Bit errors

Bit errors are defects in image caused by data transmission error between camera and phone baseband. This type of error is expected to be rare since usually missing bits will cause a hardware failure message. Bit errors can be typically seen in images taken of any object, and they should be most visible in full VGA resolution images. Viewfinder images may not contain the errors at all due to lower bit rate used in this mode. A good practice is to use uniform white test target.

The errors will be clearly visible as colorful sharp dots or lines in camera VGA images.

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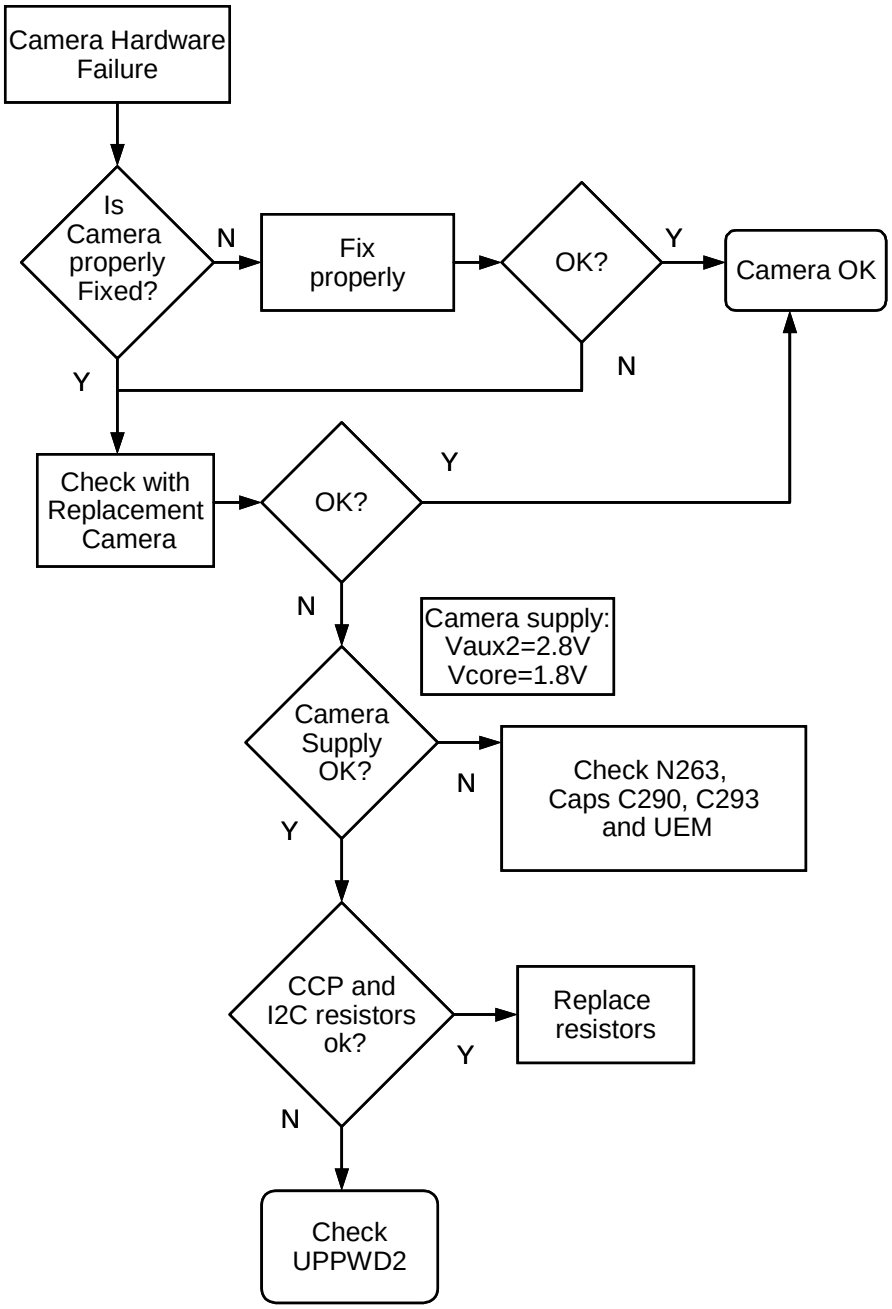
Hardware failure message



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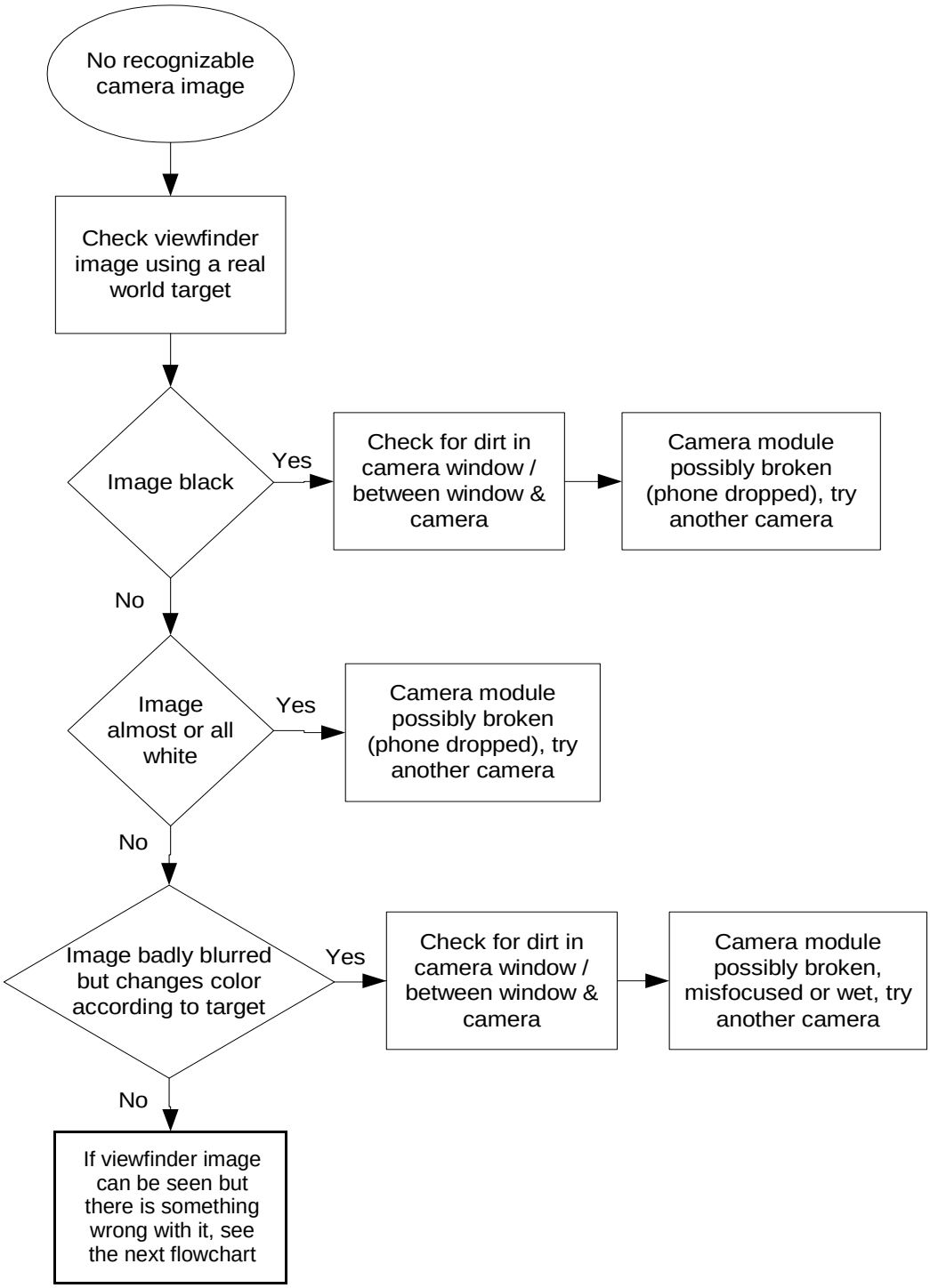
No recognizable viewfinder image


No recognizable camera image
Check viewfinder image using a real world target
Image black
Yes
Check for dirt in camera window / between window & camera
Camera module possibly broken (phone dropped), try another camera
No
Image almost or all white
Yes
Camera module possibly broken (phone dropped), try another camera
No
Image badly blurred but changes color according to target
Yes
Check for dirt in camera window / between window & camera
Camera module possibly broken, misfocused or wet, try another camera
No
If viewfinder image can be seen but there is something wrong with it, see the next flowchart

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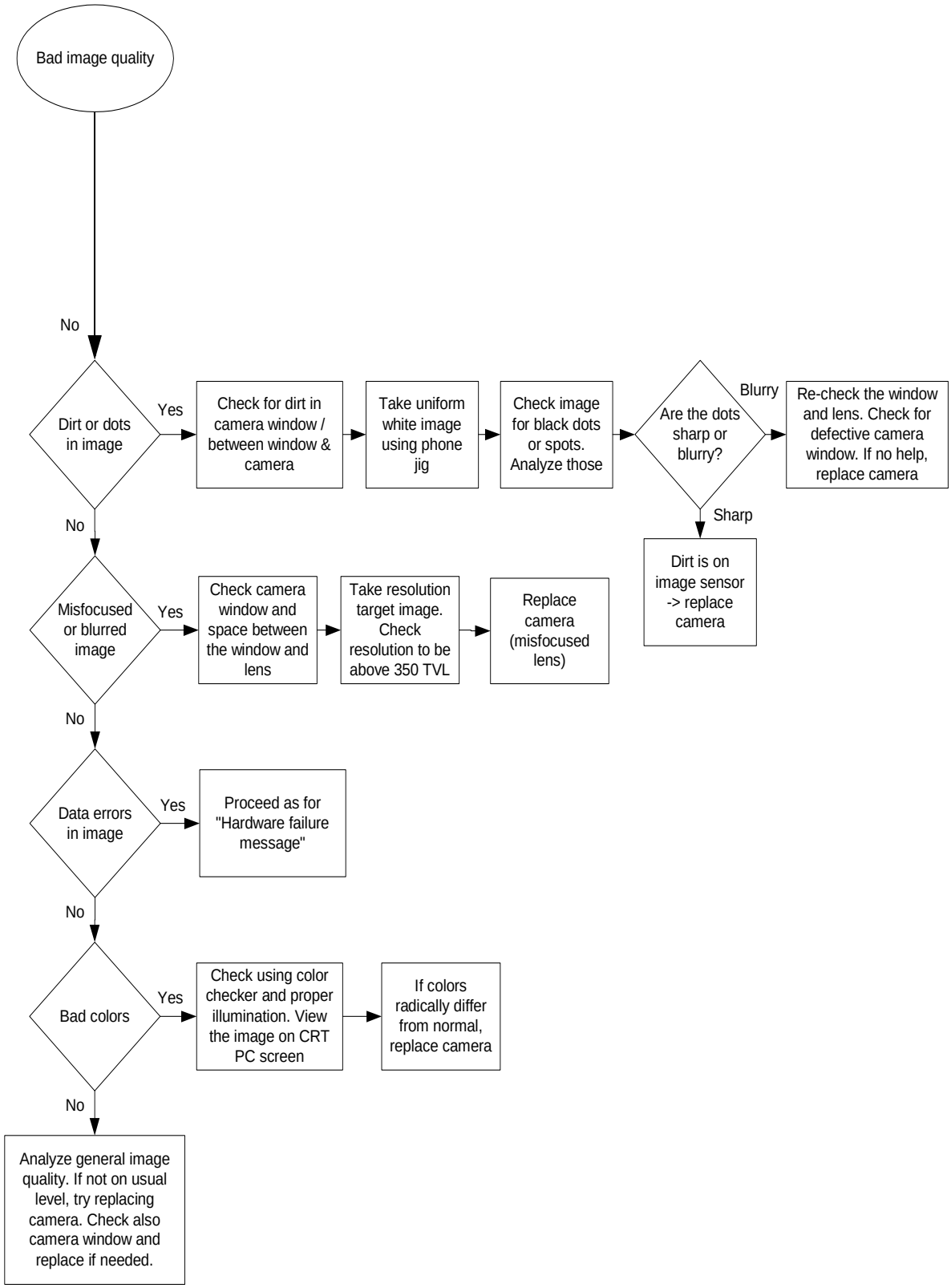
Bad image quality


Bad image quality
No
Dirt or dots in image
Yes
Check for dirt in camera window / between window & camera
Take uniform white image using phone jig
Check image for black dots or spots. Analyze those
Are the dots sharp or blurry?
Blurry
Re-check the window and lens. Check for defective camera window. If no help, replace camera
Sharp
Dirt is on image sensor -> replace camera
No
Misfocused or blurred image
Yes
Check camera window and space between the window and lens
Take resolution target image. Check resolution to be above 350 TVL
Replace camera (misfocused lens)
No
Data errors in image
Yes
Proceed as for "Hardware failure message"
No
Bad colors
Yes
Check using color checker and proper illumination. View the image on CRT PC screen
If colors radically differ from normal, replace camera
No
Analyze general image quality. If not on usual level, try replacing camera. Check also camera window and replace if needed.

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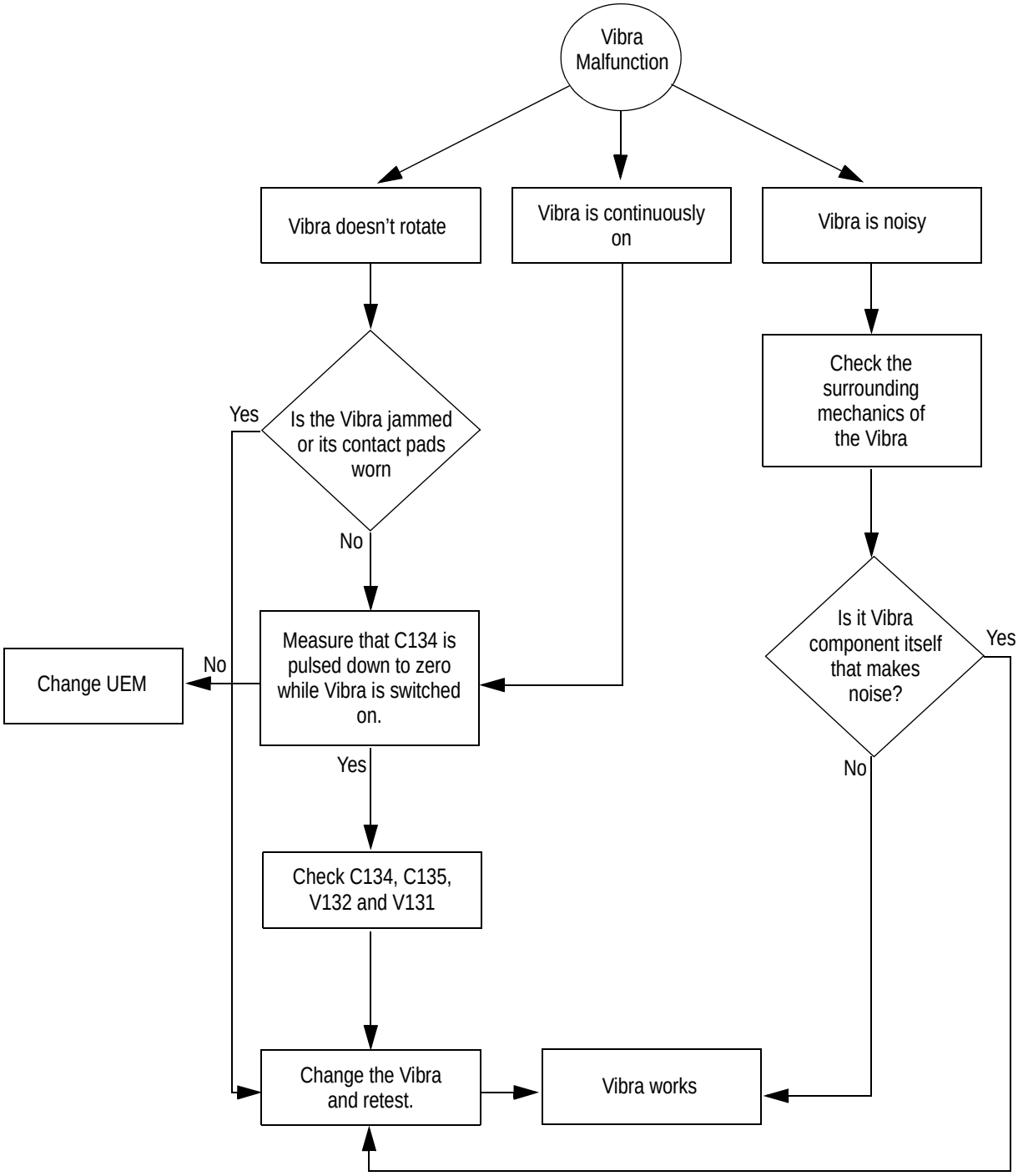
VIBRA

There may be three kind of problems concerning vibra; it doesn't rotate at all, it's noisy or it's continously on. The noisiness is usually caused by the surrounding mechanics when the rotating mass has contact to it.



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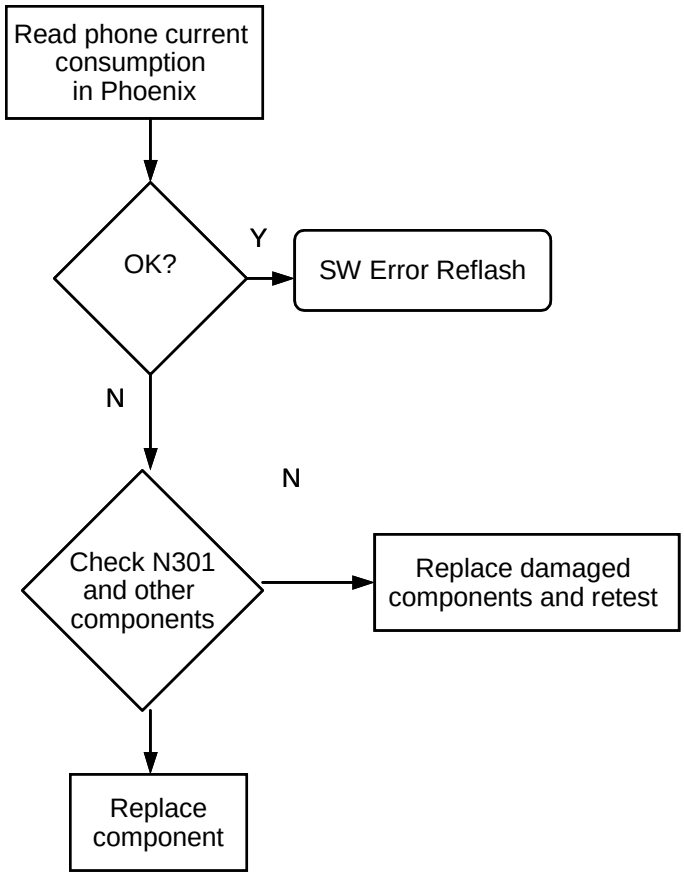
ZOCUS



UI module troubleshooting

UI module troubleshooting cases

This document describes how the trouble shooting should be done if there is something wrong with the UI function. If the problem is due to the display or keymat PWB the whole UI module should be replaced. However, the earpiece maybe replaced. (see Audio troubleshooting)

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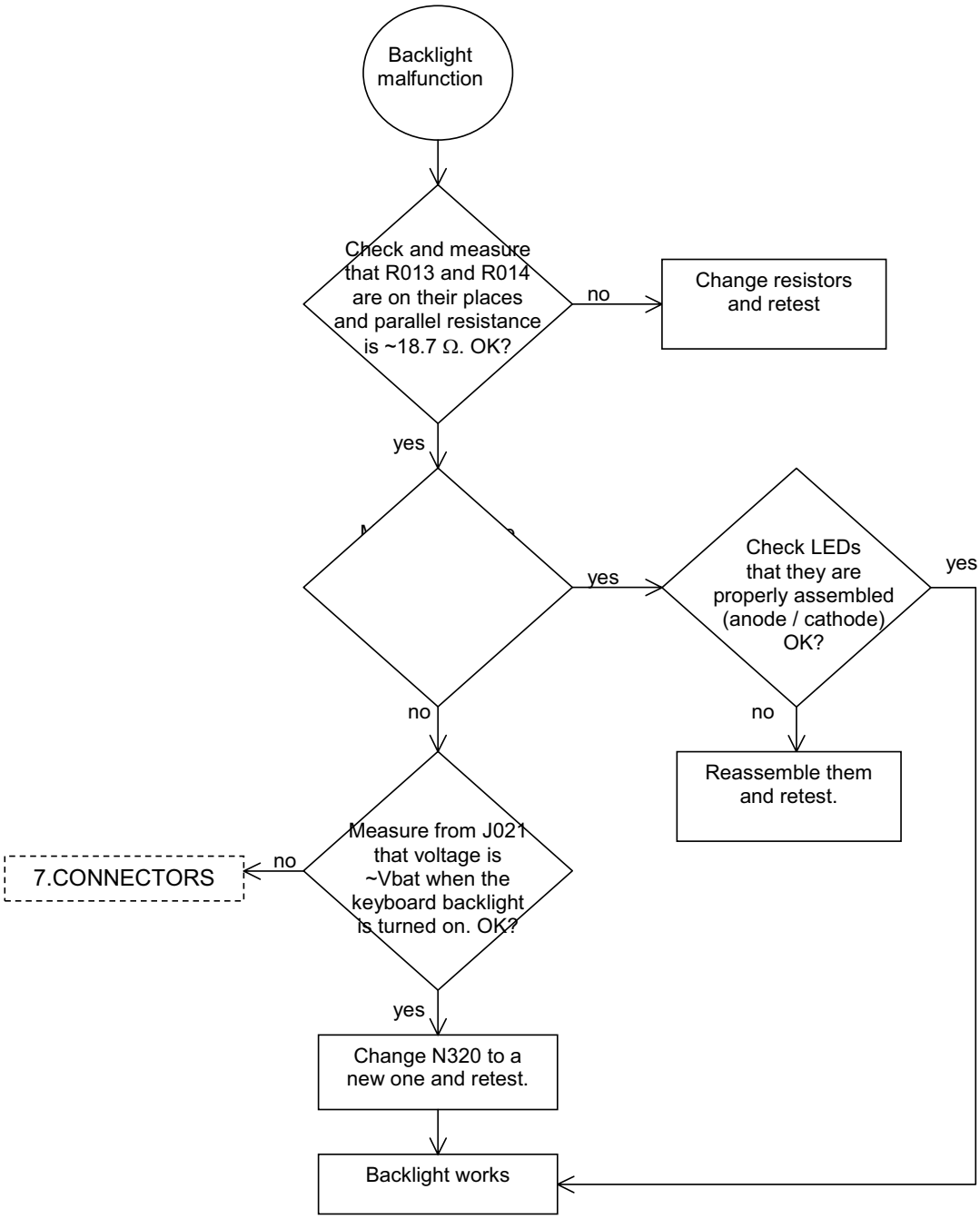
Keymat Backlight

If the keymat baclight is non-functional and the backlight driver voltage is generated correctly on the CS7 module then there is either a problem with the connector or the UI module.

Note: that it is possible for an LED to be non-functional and for all other LEDs to still be working.


Backlight malfunction
Check and measure that R013 and R014 are on their places and parallel resistance is ~18.7 Ω. OK?
no
Change resistors and retest
yes
yes
Check LEDs that they are properly assembled (anode / cathode) OK?
yes
no
no
Reassemble them and retest.
Measure from J021 that voltage is ~Vbat when the keyboard backlight is turned on. OK?
no
7.CONNECTORS
yes
Change N320 to a new one and retest.
Backlight works

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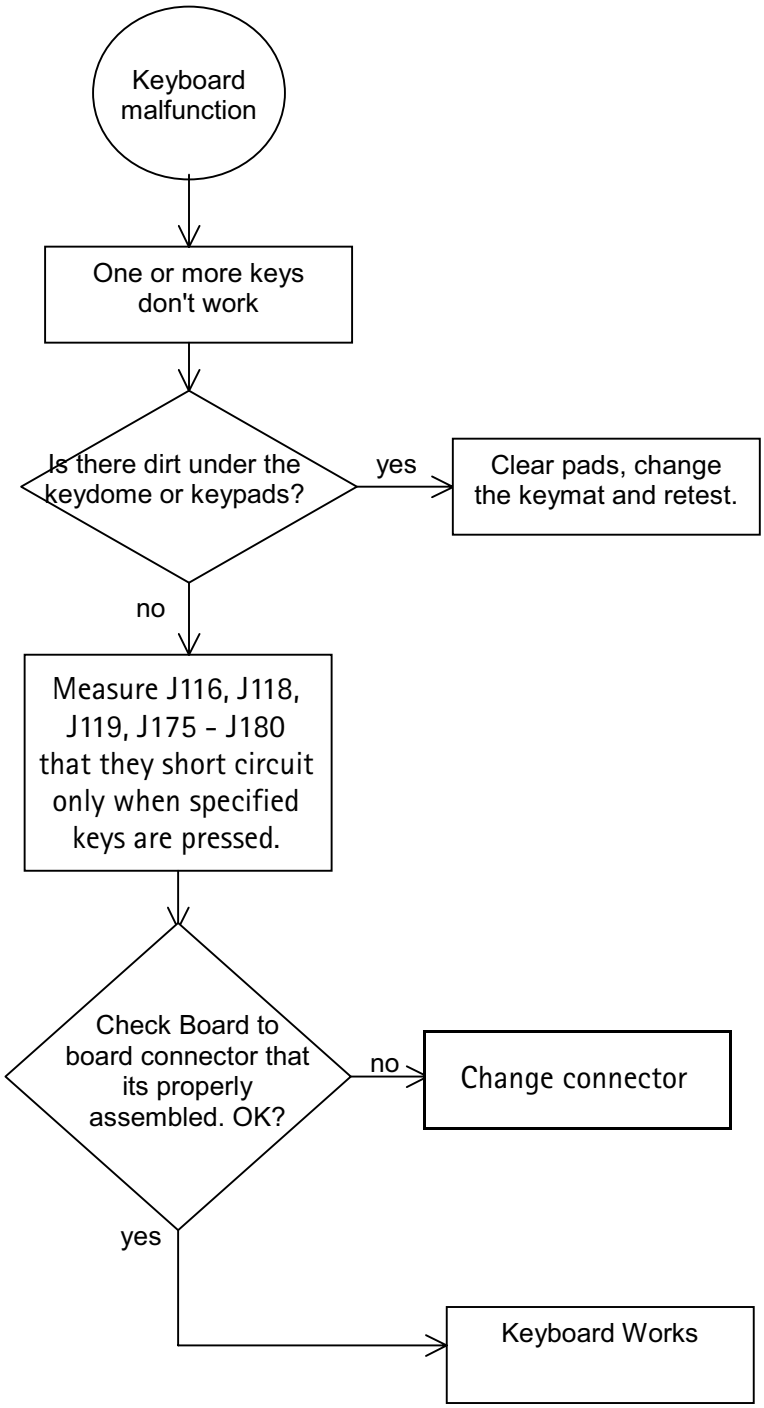
Keyboard

If keyboard doesn't work, follow the troubleshooting flow chart below:


Keyboard malfunction
One or more keys don't work
Is there dirt under the keydome or keypads?
yes
Clear pads, change the keymat and retest.
no
Measure J116, J118, J119, J175 - J180 that they short circuit only when specified keys are pressed.
Check Board to board connector that its properly assembled. OK?
no
Change connector
yes
Keyboard Works

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Display blank

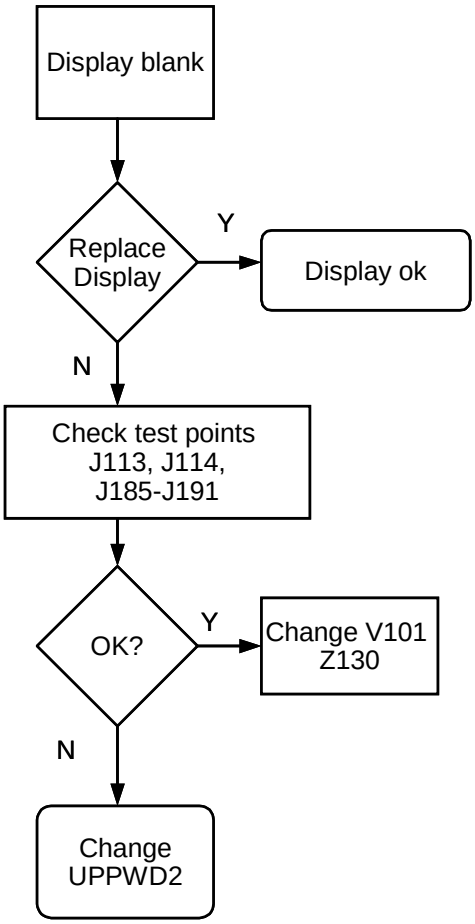

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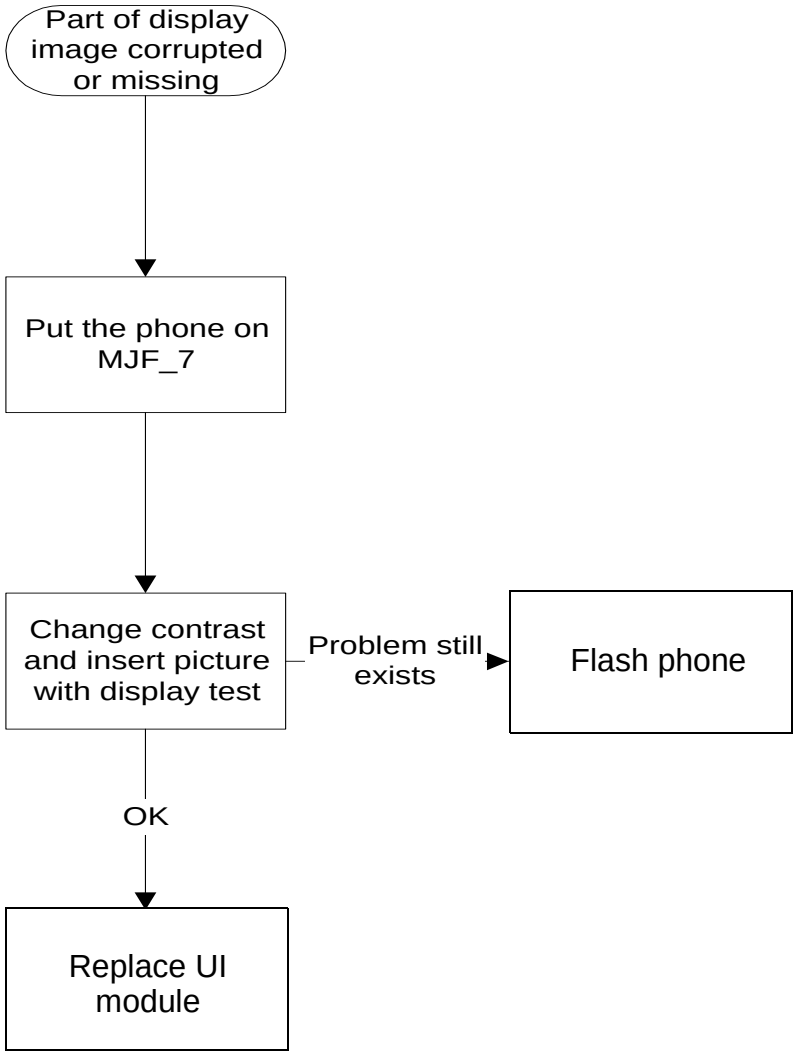
Image on display not correct


Part of display image corrupted or missing
Put the phone on MJF_7
Change contrast and insert picture with display test
Problem still exists
Flash phone
OK
Replace UI module

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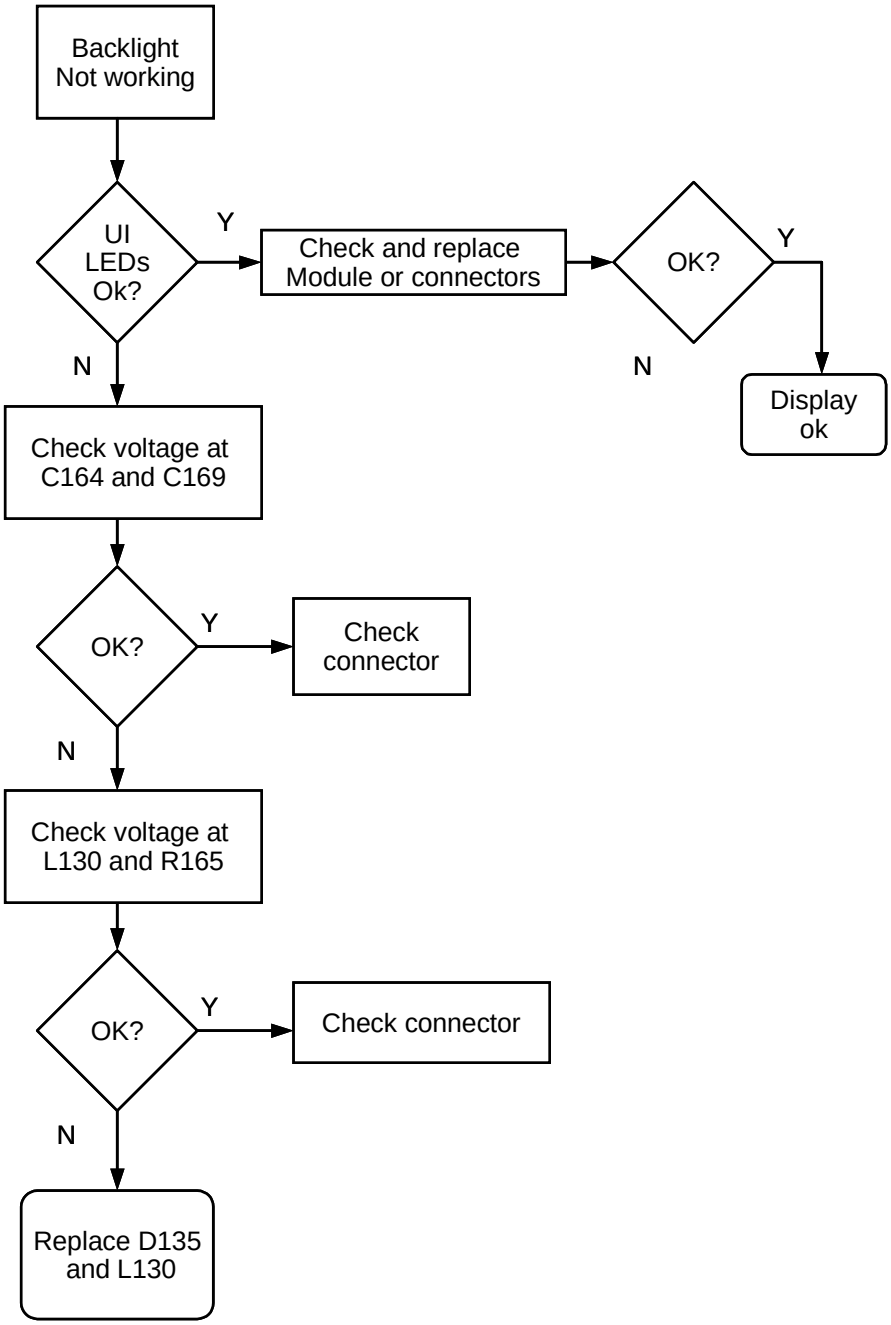
Backlight does not turn on



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